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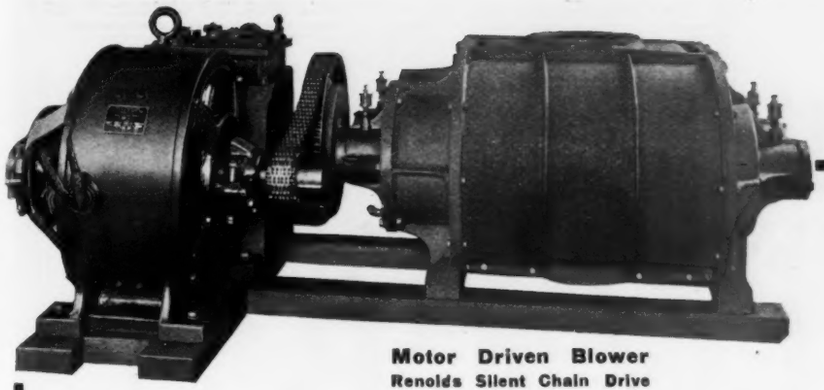

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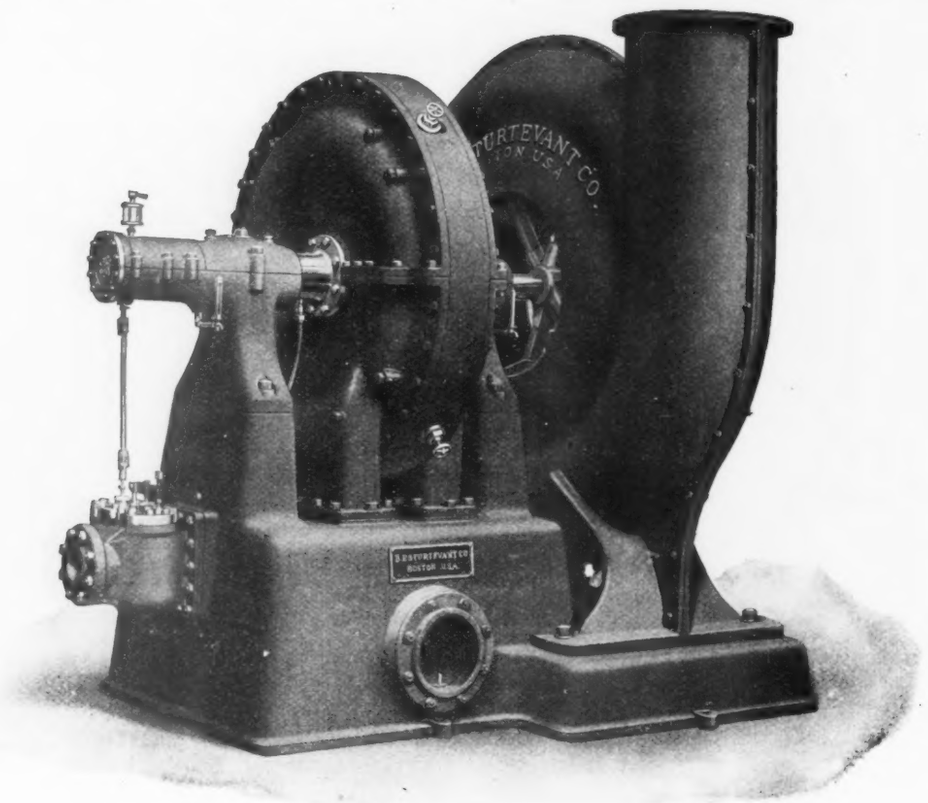

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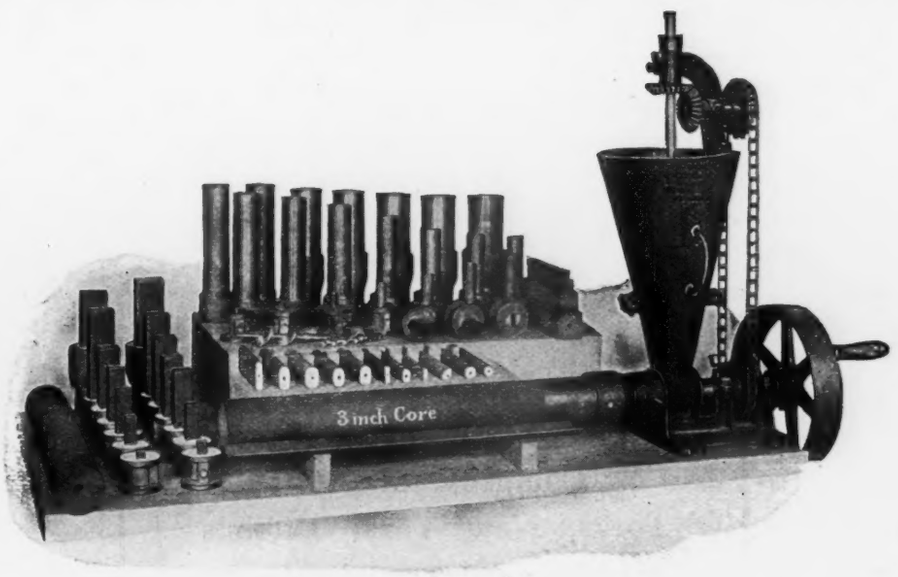

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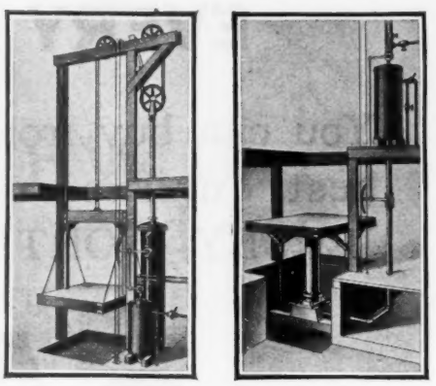

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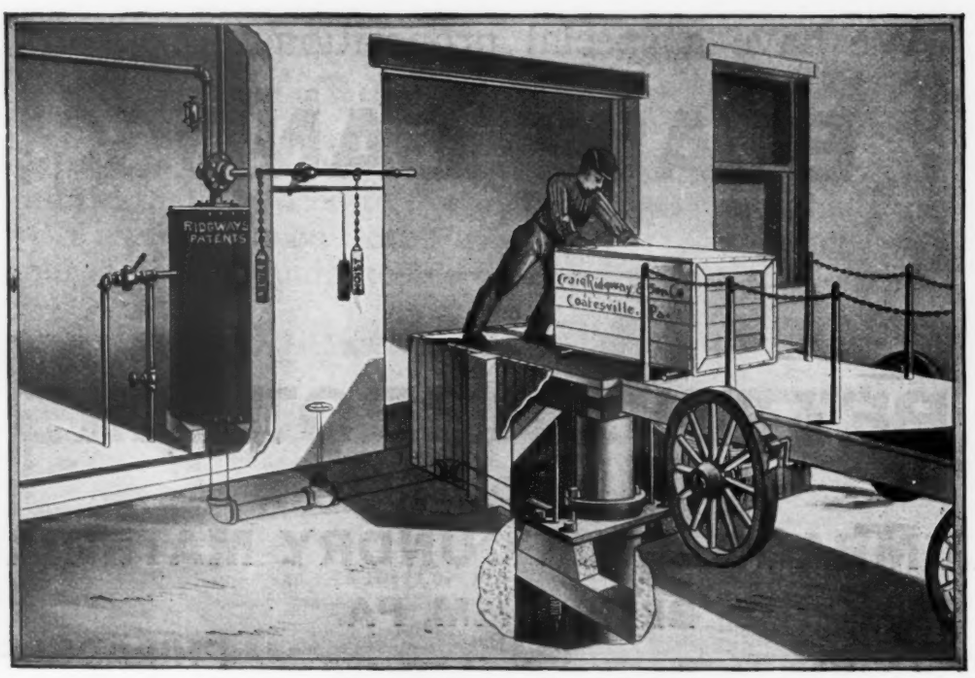

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THE FOUNDRY

Vol. 32, No. 4 CLEVELAND, OHIO, JUNE, 1908 Whole No. 190

LATTER-DAY RADIATOR PRACTICE

A Highly Developed Specialty Which Involves Many Interesting Features of Coremaking and Molding

AMONG the highly specialized branches of the foundry trade, the production of radiators takes first rank. The similarity of the sections which are produced in large numbers from day to day in shops devoted to this line of work alone, has resulted in the development of practice which can almost be considered standard. Keen competition has resulted in a marked evolution in manufacturing methods in recent years, and the casting of these steam and hot water loops has become largely a tonnage proposition. Although sold

FIG. 1—VIEW OF A CORNER OF THE FOUNDRY OF THE KING RADIATOR CO., LTD., TORONTO

FIG. 2—THE RADIATOR CORE DEPARTMENT

on a basis of square feet of heating surface, when reduced to pounds, the net price received by the foundryman is extremely low and compares unfavorably with the quotations on other castings of this grade. The difficulties encountered in radiator manufacture are not generally appreciated by the average foundryman, as the sections are simple in design and the molding and casting do not apparently involve problems new to the founder's art. The chances for heavy losses are, however, great. The metal must have a uniform thickness of 5/32 of an inch and each loop is subjected to a hydrostatic test of 120 pounds per square inch. The large cores which are made without rods or wires have also proven a stumbling block to many ambitious foundrymen who have endeavored to engage in this line.

The new plant of the King Radiator

FIG. 3—RADIATOR TESTING AND ASSEMBLING FLOOR

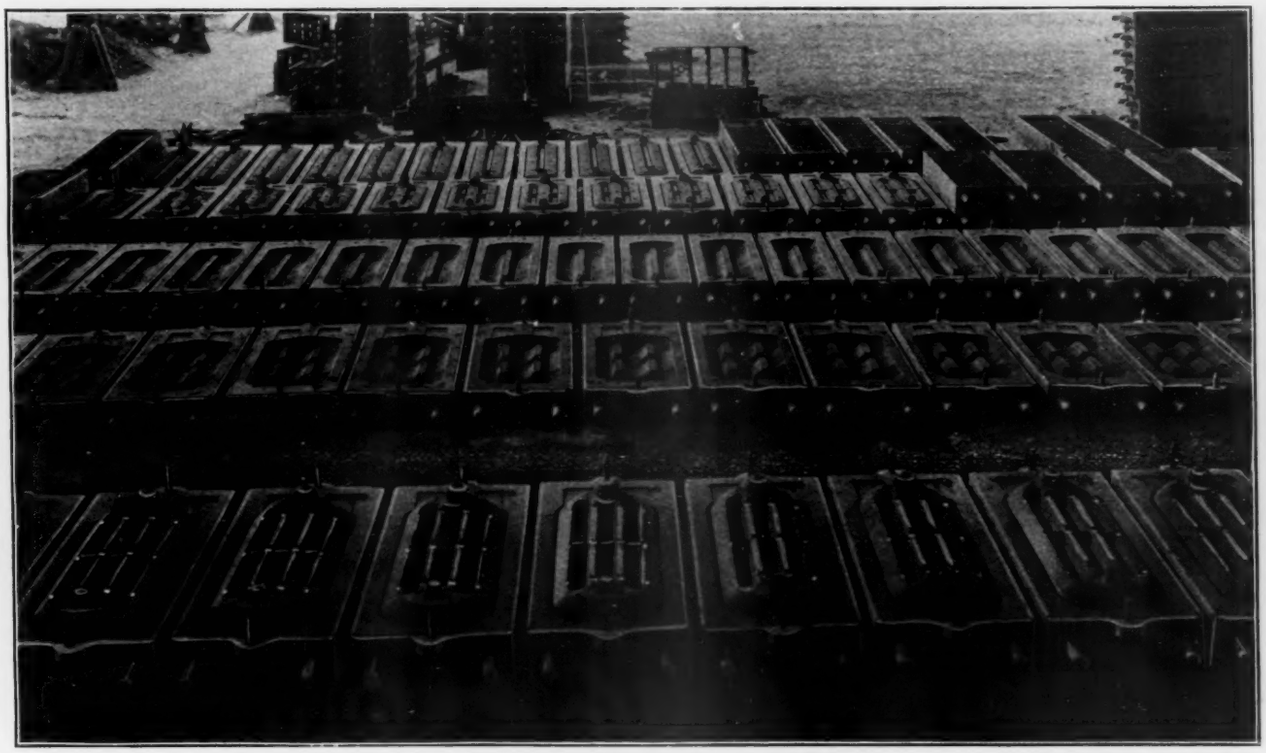


FIG. 4—SECTION OF SEVERAL RADIATOR MOLDING FLOORS

Co., Ltd., Toronto, was designed and equipped for the economical production of radiators and the operating methods pursued represent the highest development of radiator practice.

Machine Molded Radiators.

The molds are made on machines built by the company, of which about 50 are in use. The half patterns are mounted on a stationary table, as shown in Fig. 7, both cope and drag being made on the same machine. The molds are rammed by hand and are lifted from the pattern by four flask bars operated by the hand lever shown. These machines are extremely simple in design and their low cost of construction was one of the several advantages which led to their adoption. Radiator patterns have been mounted on practically all types of molding machines, including stripping plate, rock-over, jarring, auto-

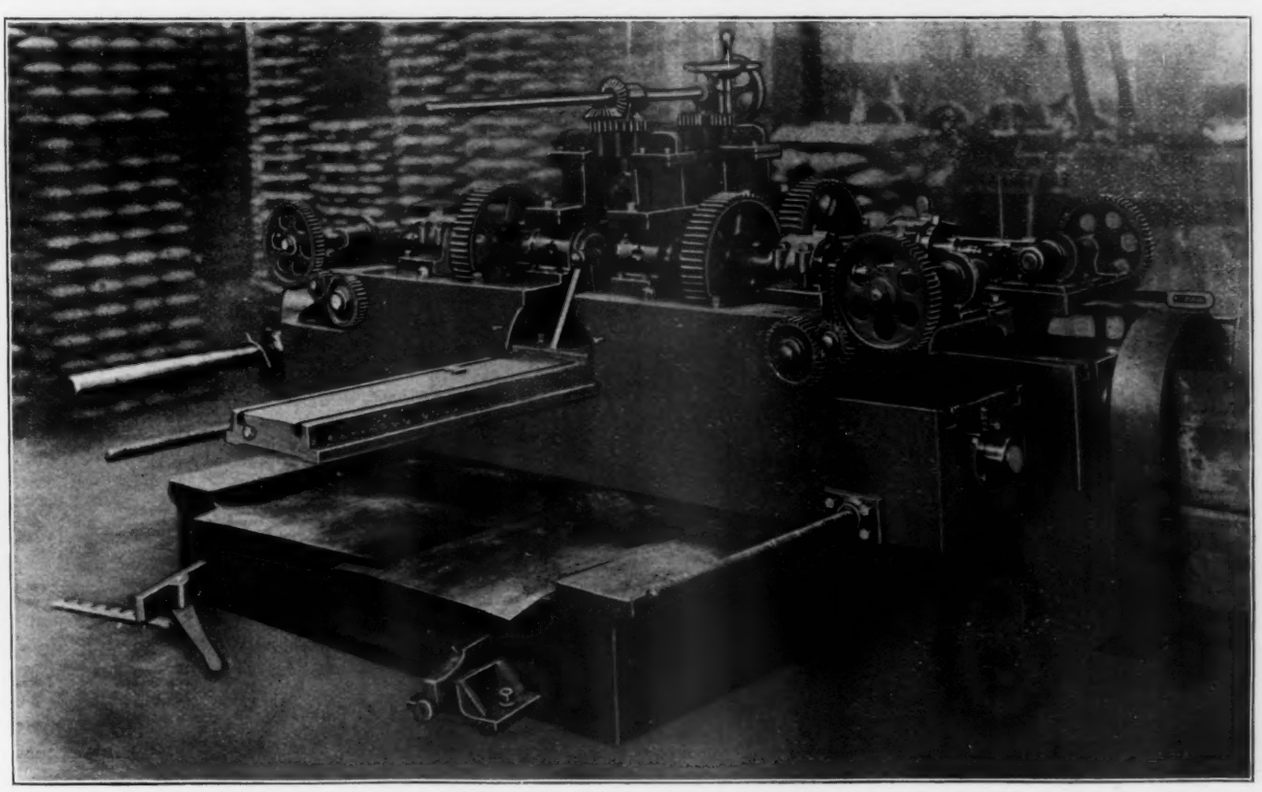


FIG. 5—RADIATOR TAPPING AND FACING MACHINE

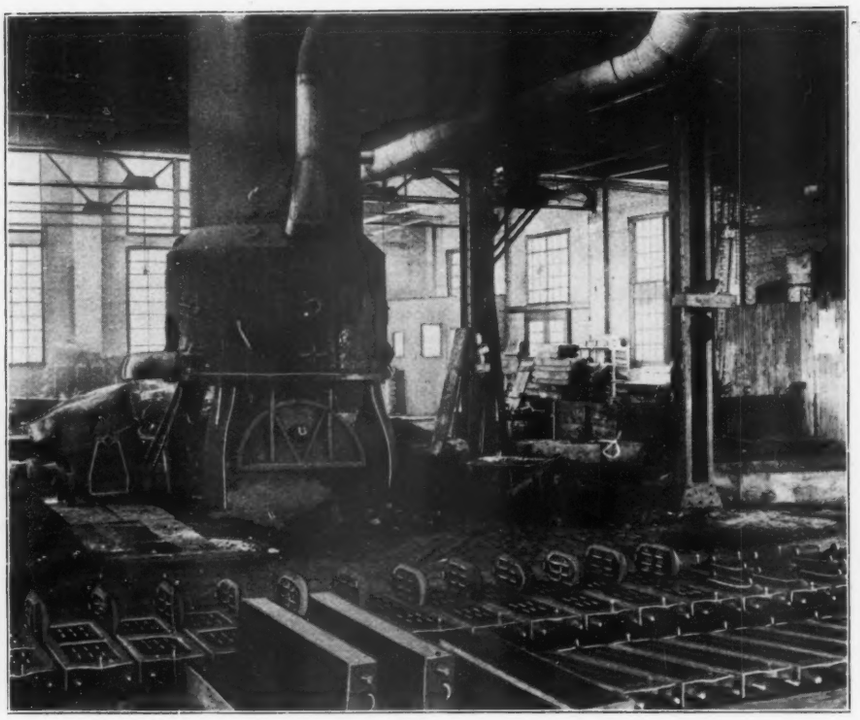


FIG. 6—THE CUPOLA

matic, etc., the manufacturers in this line having made every effort to reduce the molding cost in this way.

Practically all the radiator patterns used in this plant can be mounted on the machine shown, although a combination stripping plate and flask lifting machine is used for making wall radiator molds. Stools are provided on the latter machines for supporting the long narrow green sand cores between the columns. The stools move upward through the table when the flask is raised by the lifting bars, supporting the delicate cores until the mold is lifted from the machine.

Setting the Chaplets.

The chaplets are shown in position on the pattern and the depth that these enter the latter corresponds to the thickness of the casting, which is usually heavier at this point to allow of a flat surface being made on the core on which a small piece of tin is placed to prevent the chaplet from sinking into the core. It will be seen that when these chaplets are rammed up they are secured at the same time and require no further attention. The number of chaplets used in each mold varies with the number of columns and the length of the loop. The distance between these chaplets depends largely upon the strength of the core sand mixture used. As the force these chaplets are compelled to resist is the difference in weight between the core and the amount of metal it displaces, and as this is distributed among a large number, no great strain is placed on any one chaplet.

A section of several of the molding floors is shown in Fig. 4. In the foreground are shown the drags for four column radiator molds with the cores in place. The tins on the cores which form the bearings for the chaplets in the cope are indicated by the small white spots. These tins are pasted on the cores in the core room, usually on the cope side only.

As radiator molding is carried on without the use of bottom boards, and to give the molds the desired incline to facilitate the running of the metal, two straight edges are imbedded in each floor throughout its entire length. Between these the molder prepares a level surface with another straight edge upon which he sets his drags, after which the cores are placed, the copes rammed and the molds are closed.

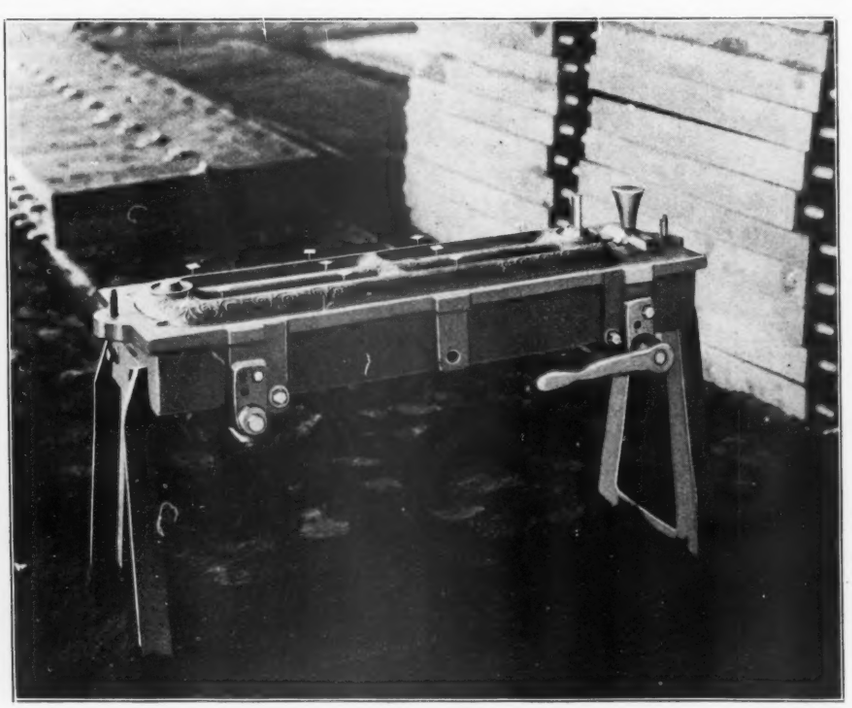


FIG. 7—RADIATOR MOLDING MACHINE

Core Room.

The core room of this plant is shown in Fig. 2. It is 50 x 100 feet in size and is well equipped for the economical production of difficult radiator cores. The four stationary ovens are coke fired from the rear, each oven being 8 x 9 feet and 7 feet high. A transfer track extends almost the length of the shop, which permits of the unloading of the core racks where the cores are stored for future use, and the racks can also be conveyed to the coremakers' benches to be loaded when empty. Each oven will hold one rack, with a capacity of 180 cores. The sand is delivered into a pit located at one end of the shop and is elevated to a mixer located on the platform by a bucket conveyor. The mixer and conveyor were installed by the Standard Sand & Machine Co., Cleveland.

Making Radiator Cores.

The making of radiator cores involves problems not frequently en-

countered by the average coremaker. The pasting of cores is obsolete practice in radiator plants, and vents have not been made with wires for many years. In Fig. 8, 1 shows the core box of a four column core. A core pan similarly constructed, in which the core is dried, is used in making the other half. After the sand has been packed in the core box and the pan, the vent plate 2 is used. It will be seen that the vents lead to one point and a corresponding vent is made in the mold to permit of the escape of the gases through one opening. After the vent plate has been applied to both halves of the core, the core box 1 is closed over the half core in the pan, rapped and lifted off. This operation finishes the core, which is set on a rack in the pan. As the cores are made entirely without rods or wires, a sand mixture must be used that will permit them to readily leave the castings. As the metal very nearly covers the core the reason for striving in this direction is apparent. A good, sharp sand is generally used, mixed with linseed oil and resin. In Fig. 8, 3, 4, 5, 6, 7 and 8 show a variety of radiator cores. These are made to withstand rough handling in both the core room and the foundry.

The Foundry.

The general view of one section of the foundry is shown in Fig. 1. This department is 200 x 110 feet and is divided into three bays. The building is of steel and brick construction and is well lighted on four sides by double windows 8 x 10 feet in dimensions. The foundry has an extreme height of 34 feet and ventilators extend the length of both sides of the monitor. A mashway in the center of the shop extends its entire length, the molding machines being arranged along the sides of the building.

Melting Equipment.

The cupola shown in Fig. 6 is located in the middle bay at one end of the shop and taps into a skimming ladle from which the molders secure their iron. The skimming device consists of an arch built of bricks across the diameter of the ladle, the metal passing through the opening underneath to the lip of the ladle. The cupola is lined to a diameter of 52 inches and blast is furnished by a Connersville blower driven by a 20-horsepower motor. This set is mounted on an elevated enclosed platform. The charging floor is 32 x 40 feet and is provided with a scale at the elevator opening, on which the charges are weighed before being dumped into the cupola or piled for future use.

The cleaning room is 45 x 50 feet and is equipped with five tumbling mills installed by the Whiting Foundry Equipment Co., Harvey, Ill. The mills are driven by a 20-horsepower motor.

Testing Department.

The testing and assembling shop, one of the most essential departments of every radiator plant, is 250 x 107 feet. A section of the testing floor is shown in Fig. 3. The radiator sections before shipment are subjected to a hydrostatic test of 120 pounds per square inch for leaks in the connections. The facing and tapping machine, Fig. 5, taps four openings and faces each end of a radiator in one operation. It is adjustable for radiators of various lengths and widths. An assembling machine is used for fitting the loops together. Before the loops are tapped and faced they are subjected to a hydrostatic test singly, for defects, and if found imperfect they are consigned to the scrap pile.

A well equipped machine shop is located in one corner of this building. Here the metal patterns are finished and mounted on the molding machines and the cast iron flasks, which are used exclusively, are fitted and faced. The flasks are simple in design, being made without bars, as this has been found to be a needless expense. All of the tools and equipment are electrically driven by individual motors, the current being transmitted from Niagara Falls. The plant is heated throughout by an over-head hot air system. The foundry has a daily capacity of about 40 tons or 2000 loops. R. J. Cluff is manager of the King Radiator Co., Ltd., and G. A. Burman is superintendent of the plant.

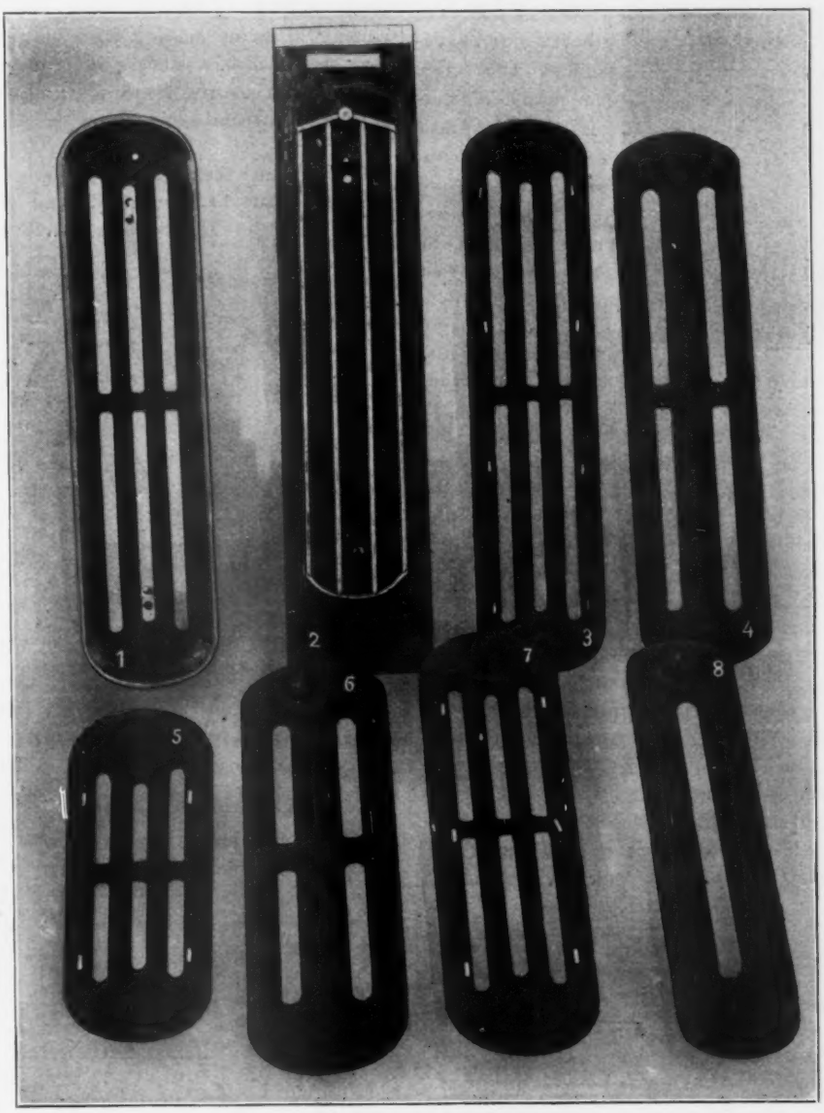


FIG. 8—CORE BOX FOR RADIATOR CORES, VENT PLATE AND ASSORTMENT OF CORES

ERRORS IN THE DESIGN OF PATTERNS

Discussed from a Foundry Point of View—Changes Suggested That Will Overcome Many Difficulties

BY PAUL R. RAMP

VERY FEW engineers and designers appreciate the many difficulties the foundryman has to contend with. They figure that a certain tensile strength per square inch will be a safe margin and build their machinery accordingly. They sometimes specify a certain tensile strength per square inch for a casting but do not design the casting to suit the tensile strength specified. These are the conditions that work hardships on the foundryman. In designing a casting that will be subjected to a high tensile strain the sectional construction should be very uniform, as an iron of a high tensile strength is generally high in shrinkage, and the ugly heavy sections that are often put in by the designer result in shrinkage cavities.

The same is true of castings that are subjected to a high steam or hydraulic pressure, and it is because engineers do not give the many peculiarities of cast iron and its action while solidifying in the mold enough consideration in making their designs, that it becomes necessary for the foundryman to resort to all kinds of expensive methods to prevent defective work.

It is true these crudely designed castings can be produced and are made daily, but their production is attended with more difficulties and expense than is necessary.

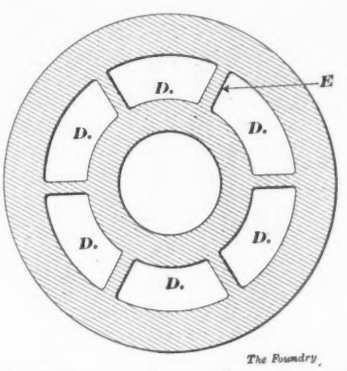


FIG. 3—SECTION OF CROSS-HEAD STRENGTHENED BY INCREASING THE NUMBER OF RIBS

High Pressure Castings.

In making high pressure castings, it is more important to design the same with a view to simplifying the shrinkage problem, than to design with a view to simplifying the molding problem. We hear a great deal about fillets on patterns, draft of patterns, green sand molds taking the place of dry sand or loam molds in the production of castings, which no doubt are factors affecting the cost of labor, etc., but these are questions that the foundryman himself can handle, and his experience should be sufficient to qualify him to judge what changes of this kind are practical. But when it comes to the design of a casting, he is helpless, and is supposed to make whatever they give him, and his objections to the manner in which the casting is designed are frequently listened to in a patronizing way. As he is not supposed to be on a level with the mechanical engineer intellectually, his objection has no real weight, and the consequence is that he must devise ways and means to cure a disease in a casting that could just as well be prevented.

The fact that these little troubles with cast iron caused by the formation that takes place as it leaves the liquid state and changes to the solid, are not a part of the engineer's or designer's course in college, and are the conditions that the foundryman must cope with daily to maintain a reputation generally brands him a chronic kicker.

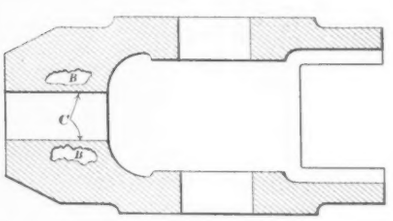


FIG. 1—SECTION OF CROSS-HEAD CASTING SHOWING SHRINK-HOLE

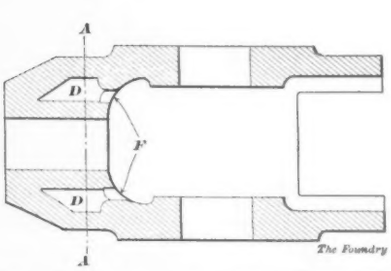


FIG. 2—REMEDY FOR THE DIFFICULTY SHOWN IN FIG. 1

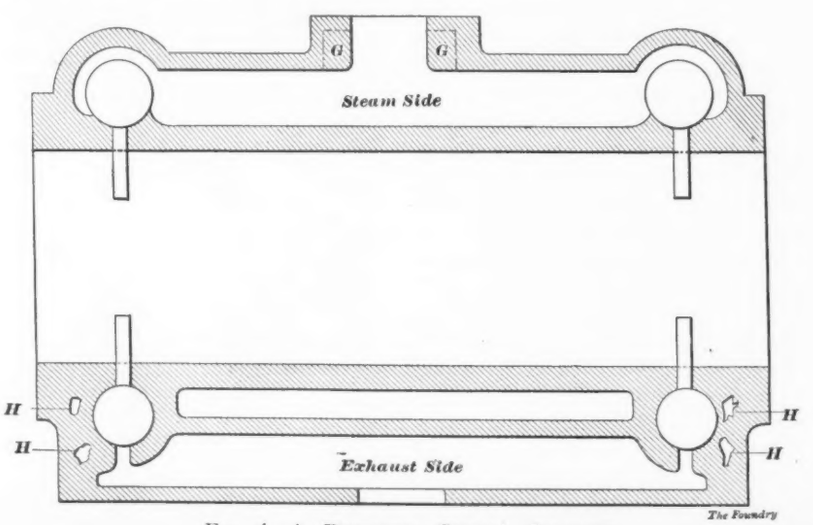


FIG. 4—A DEFECTIVE CORLISS CYLINDER

It is often said that the foundry foreman, like a molder, has always at his command, an unlimited supply of apparently feasible excuses for his losses, and it has been suggested that many of them are not to be considered; however, let us take away from him some of these things which we know help to make defective, unsound, or unsafe castings, and he will then have no corrections or excuses to suggest, except the change in his own methods. The following examples embody a few suggestions on this subject. While some are contrary to what has been considered the best and most up-to-date practice of cast iron design, they are wrong and should be corrected.

Cross-Head.

Take for instance a cross-head casting. This is a section that the majority of foundrymen have trouble with. The writer's brother had at one time an appropriation made by his company for the purpose of experimenting with the molding and casting of cross-head castings.

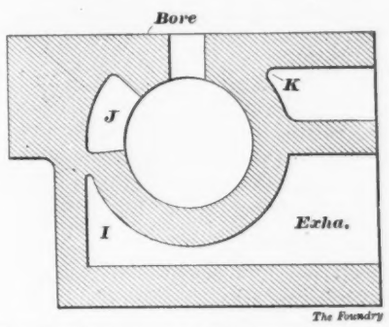


FIG. 5—REMEDY FOR OVERCOMING DEFECTS SHOWN IN FIG. 4

The plan was to have each casting cut in two, showing the condition of the cross section, and the effect of the different methods of pouring, gating, feeding and the iron mixture best suited for the heavy section. It was proven beyond a doubt that the method of gating and feeding made no difference in the solidity of the cross-head, and that the best head with the least amount of shrinkage was produced from an iron mixture that contained manganese, 0.80 per cent; silicon, 1.30 per cent, and phosphorus, not over 0.80 per cent. A charcoal iron was used with 10 per cent of steel scrap, and no risers or feeding head was required.

This special mixture would appear to be the solution of the cross-head trouble, still it is very unhandy to make a special iron for a few heads every day and the expense involved is heavy.

Change in Design.

The proper way to overcome this trouble is to alter the design of the cross-head. Fig. 1 is a rough sketch of a cross-head casting, showing a cross section through the center. The shrink hole that is always present is shown at B unless a special iron mixture is used, and the pouring temperature carefully watched. This casting must be bored out and a thread cut at C for the piston rod to be screwed into it. Very often the machinist will run into the flaw B, while cutting the thread.

The reason that some heads are more solid than others is because the quality of the iron varies, and some days it may be too cold, other days it may run high in sulphur, etc. While this variation in the iron may not be sufficient to cause any trouble in the production of castings of a uniform thickness, or the ordinary castings made in the shop, nevertheless the cross-head will always suffer and will be an unknown quality. It is an easy matter to blame the foundryman, and it is easy for the foundryman to promise to do better, but there is always a danger of loss, as long as the design calls for a heavy section as shown in Fig. 1.

In Fig. 2 is shown a remedy for this trouble which is accomplished by coring out the metal at DD. The sketch shows the opening a little larger than necessary to make the meaning plain. The cored out part at D need be only a little larger than the shrink-hole generally found at this point. Cross section AA shows how this part of the head may be strengthened by means of the ribs E; the designer may put in more ribs than are shown in Fig. 3. Anyone familiar with the action of melted iron after it has entered the mold and has commenced to congeal, cannot help but agree that the cross-head shown in Fig. 2 will be the strongest and safest casting.

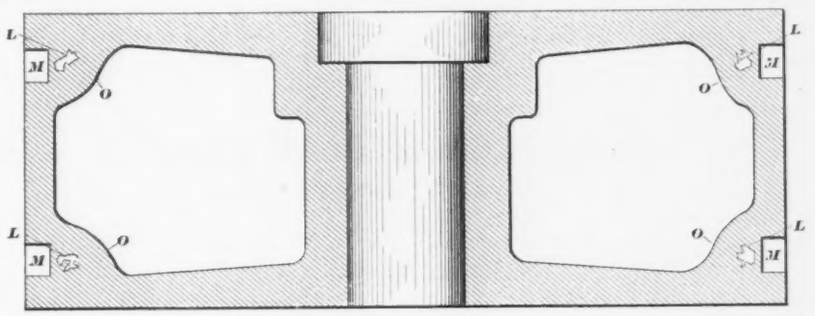


FIG. 6—DEFECTIVE PISTON HEAD

This plan will keep the foundryman out of trouble with the machine shop. These openings can be formed by extending the main core of the cross-head mold into the heavy section.

A Corliss Cylinder.

A Corliss cylinder is sometimes designed without a consideration of the foundry problems. Figs. 4 and 5 represent a cross section of one of these castings, which will show the variation in the metal thickness, and the occasional results.

The defects H are the result of a heavy section of metal at that point that could just as well be eliminated, which would insure a sounder casting, and a stronger one, to say nothing about the saving of metal.

The portion of this casting that surrounds the steam opening, indicated by dotted lines and the letter G, should be cut out. Fig. 5 is a rough sketch of one corner of the cylinder casting on the exhaust side.

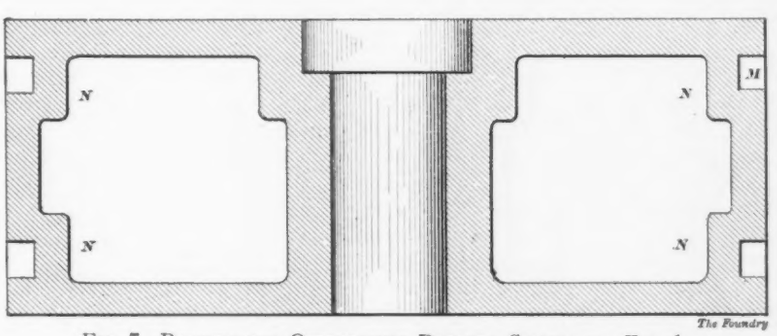


FIG. 7—REMEDY FOR OVERCOMING DEFECTS SHOWN IN FIG. 6

At I and J are shown how the defect shown in Fig. 4 could have been obviated. The exact size of these openings is of no great importance, but the principle involved is very essential to the production of cylinders that will not leak when made from an ordinary iron mixture. K shows an-

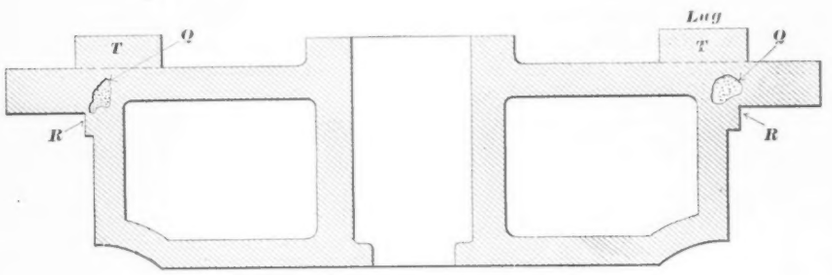


FIG. 8—DEFECTIVE CYLINDER HEAD

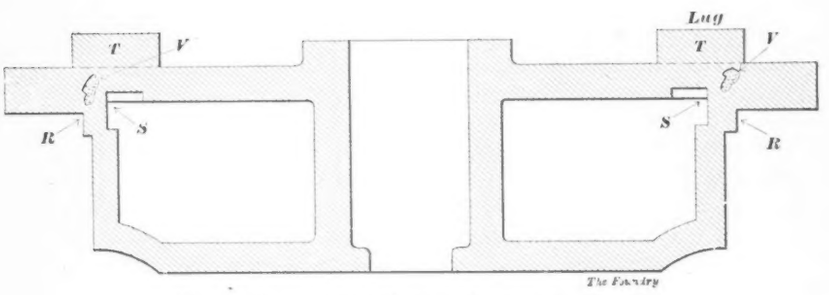


FIG. 9—REMEDY FOR DEFECTS SHOWN IN FIG. 8

other point of this design that the engineers have evidently overlooked. A great deal of the trouble in the manufacture of cylinders, water jacketed and otherwise, can be easily traced back to the lack of due consideration of the foundry problems.

A Solid Piston Head.

Figs. 6 and 7 represent the cross

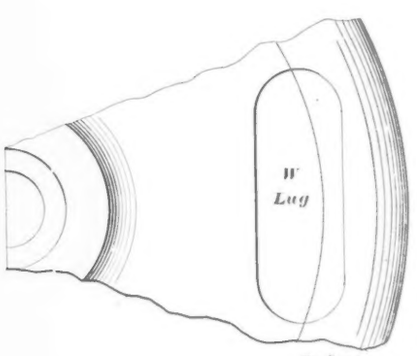


FIG. 10—ERROR IN THE DESIGN OF THE LUG

section of a solid piston head. The engineer in designing this casting with a view to securing a very strong construction, overreached himself, which resulted in a section that would never be safe. The heavy section and numerous irregularities, destroy all the good points of the design, and make this head a menace to engine builders. The artistic curves shown at O look very nice on paper, but one familiar with foundry practice can readily see that they are detrimental to the casting, and the heavy section that they form will generally create a defect at the point shown at L in Fig. 6. This defect generally takes the form of a shrink cavity, or a spongy section, which is always in evidence when the mold is poured with iron that is below the desired temperature, or when the lightening cores are not thoroughly dried, or the material used to make them is too close. This proves that this style of a head is a difficult casting to make and one that cannot be relied upon unless the greatest care is exercised in the selection of the metal mixture, sand, and every other detail in connection with its production.

How much easier it would be for the foundry to produce a strong, solid and perfect casting of this kind, if the internal design of this head were made similar to Fig. 7. The engineers would undoubtedly condemn the construction of the head shown, on account of the square corners, etc, but these square corners really add to the strength in this case, and do away entirely with the irregular and varied shrinkage cavities. It is safe to assert that when it comes to the question of durability, the head shown in Fig. 7 is far superior to the design shown in Fig. 6, to say nothing of the saving of unnecessary metal, and the tremendous reduction in losses. The grooves for the piston ring shown at M, Fig. 6, should be formed with a core, rather than cut out on the machine. Engineers should specify this on their blue prints when they are sent to the patternmaker.

Steam Jacketed Cylinder Heads.

Fig. 8 is a cross section of a steam jacketed cylinder head. The designers of this head did not evidently consider the internal construction of much importance. The error in this design is in connection with the two oblong lugs TT, Figs. 8 and 9, and marked W in Fig. 10. It will be seen in Fig. 8 that these lugs come right over the flaw marked Q, which is very liable to extend into the corner of the head at R, causing a leak. The lugs were probably not considered of much importance because they did not extend all the way around the head, but only a short distance as shown in Fig. 10. The result in the design was several bad castings leaking at RR.

The remedy for this trouble is shown in Fig. 9. The point marked SS is cut out, and if a completely solid casting does not result from this method, the worst thing that could occur would be a flaw as shown at V and V', which would be so far removed from the parts that are to be machined that they would not cause any trouble even if a poor grade of iron were used.

A High Pressure Tee.

The question has often been asked, "What is the best iron mixture to prevent a shrink or a leak behind the flange of a cast iron pipe?" Var-

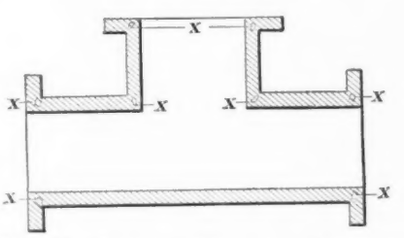


FIG. 11—CROSS SECTION OF DEFECTIVE HIGH PRESSURE TEE

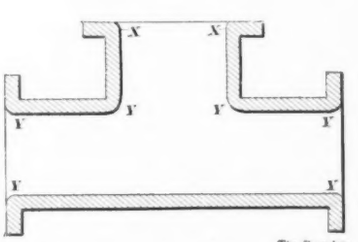


FIG. 12—REMEDY FOR DEFECTS SHOWN IN FIG. 11

ous iron mixtures and many different methods of molding have been suggested to overcome this evil. But why would it not be better and cheaper to get down to the cause of this defect, which is undoubtedly in the design? Fig. 11 represents the cross section of a tee that specifications state must stand a high steam pressure. Castings made after this design are always spongy and sometimes hollow at the points indicated at X in Fig. 11. This is due to the heavy section formed by the flange joining the pipe at this point. A good remedy for these defects is shown in Fig. 12, which differs from Fig. 11 at the points marked Y. This is a simple change, but very effective. In case of an objection to these round corners cutting off the flange surface, the flange itself can be enlarged without affecting the shrinkage. A high pressure casting is more liable to result when made as shown in Fig. 12 with a poor grade of material than when made as shown in Fig. 11 with the best material.

These suggestions and changes in the design of these castings may appear to the engineer as trivial and of very little importance, but from a practical foundryman's point of view, they are the factors, which if carefully observed, will enable him to get the best there is out of cast iron.

THE CLASSIFICATION OF PATTERNS

A Modern System for Recording Patterns Required for Various Classes of Castings—Materials Used

BY OSCAR E. PERRIGO

IN formulating plans and systems for the management of the work of the pattern shop, and for recording the facts as they occur in its routine business with a view to accounting for and preserving a record of all its operations we shall find it advantageous to analyze the various processes and to make a more or less complete classification of the different materials used, the kinds of patterns made, the methods of making them, and the various ways of using them in producing castings. This will enable us to take up the work in detail and to understand its working conditions, so that we may note its advantages and disadvantages, and adopt such plans as may be best suited to every day work best calculated to lead to successful management when considered from the practical standpoint of producing good patterns, and at the same time keeping the expenses within reasonable and economic limits.

Before proceeding with the classification of patterns, even in a general way, it may be well to understand distinctly and definitely what we mean by a pattern in this connection, as there are a great many kinds of patterns and they are used for a great variety of purposes, and in all industrial vocations.

Art of Patternmaking.

The art of patternmaking, as understood in connection with the building of machinery, may be defined as the production of a pattern or model of suitable material, as wood, metal, plaster, or other substance, from which a model may be made in sand or loam, from which in turn, a casting may be produced in any desired and suitable metal, when poured into it in a molten state.

In a broad and general sense, patternmaking includes not only the work of building up the pattern in such form, and in such parts, together with suitable core boxes as will be capable, in the hands of the molder, of producing the castings desired; but, inasmuch as the design and drawing of the engineer or draftsman represents only the piece after it is cast, and frequently after it is entirely finished by hand and machinery, it includes the designing of the pattern, however complicated it may be in itself, or in the core boxes which are a part of it, in such form that it may be practically and economically molded, and successfully produce castings of the form and dimensions required.

Classes of Patterns.

In a general way, all patterns may be divided in two classes, wood and metal patterns. These two classes have many and wide differences, so much so as to really constitute two different trades which we commonly know as wood patternmaking and metal patternmaking. While the wood patternmaker may be called upon occasionally to make metal patterns, or metal parts attached to wood patterns, the metal patternmaker scarcely ever attempts to make wood patterns, except perhaps to make a very rough pattern from which he may obtain a casting which he can work up by machine or hand work into the pattern he desires.

Classification of Wooden Patterns.

Wooden patterns may be classified into three groups, as to their uses. First, those of a temporary nature which are generally used only once. They are made of a low grade of lumber, nailed together rather than fastened by wood screws. Glue is seldom used. They are rather roughly finished, and the pattern is not usually protected by any kind of varnish. If dowels are necessary they should be of wood. Generally no draw plates are required. After being used, these patterns are generally thrown into the scrap heap.

Patterns Occasionally Used.

The second class consists of such patterns as are only occasionally used, but which it is necessary to preserve for future use. Consequently they are made of a better grade of lumber, and more time is spent in their construction. They are generally of as few pieces as possible and these are fastened with glue and nails. But little time is spent in making nicely rounded corners and where fillets are necessary they are made with wax. Wooden dowel pins are generally used, and draw plates are not usually necessary. They should have at least one coat of shellac varnish, more as a protection for the joints and to prevent their falling to pieces from shrinkage than to facilitate their easy drawing from the sand. These patterns are usually marked and recorded as special pat-

terns and stored apart from the standard patterns.

Standard Patterns.

The third class comprises the standard patterns that are in frequent and continual use. They are usually in complete sets representing all the castings for a certain machine. They are recorded in a card index, book, or in standard lists; sometimes by all three of these methods, in various departments. They should always be made of a good quality of thoroughly seasoned pattern lumber, well constructed of properly "glued-up" material so as to avoid warping and distortion by the severe atmospheric changes which they will have to undergo. They should be provided with metal dowel pins and draw plates and if made of pine, all small, loose pieces should be made of hard wood, preferably cherry. Very thin parts and outwardly projecting, sharp angles should be of hard wood also. Fillets should be of leather or wood, well fitted, glued and bradded in place. They should be numbered with sharp face pattern letters and figures, and should be protected with three coats of shellac varnish, the first two well rubbed down.

Division of General Classes.

The general classes enumerated above may be still further divided according to the weight of the castings in each class. These may be arranged as follows:

Heavy machine patterns, such as required for the heavy castings for water works, stationary and marine engines, rolling mill and sugar mill work, large dynamos and motors, large beds for heavy lathes, planers, boring mills, and special machine tools, bases of large dimensions, and all similar work weighing over 10 tons each.

Medium machine patterns, such as those for the castings of large engine cylinders, the beds, tables, bases, etc., of machine tools, printing presses, medium sizes of engines, dynamos, motors, presses, water wheel work, boiler and furnace work, weighing from 1 to 10 tons each.

Light machine patterns, such as those for the casting of lathe heads, carriages, aprons, milling machine bases, tables and knees, medium sized engine cylinders, beds, frames, gears, printing press parts, machine tool parts, general machinery parts, and all similar work weighing from 100 pounds to one ton each.

Light machine patterns, such as those for castings of the parts of small lathes, planers, milling machines, printing presses, engines, pumps, gears, levers, pulleys, couplings, gas and oil engines, and a large variety of general machinery parts, weighing less than 100 pounds each.

Special Patterns.

There are also special classes of work quite distinct from these classes requiring considerably different treatment, not only in respect to the methods of making the patterns but in the management of the work and accounting for the time and material expended on them. This will be the case with cast iron pipe work, which includes large valves and gates, elbows, tees, bends, and in general all the fittings for street mains, sewers, water works fixtures, turbine wheel work and fixtures, and work for similar purposes and uses.

Another class of which some foundries make a specialty includes architectural or structural cast iron work, such as columns, brackets, wall plates, post plates, ornamental panels, railings, balustrades, and a great variety of similar work for building purposes.

A class of special work includes patterns a large part of which consists of thin plates, as the sides of fan blowers of various forms. These patterns would be very expensive if "built up and dug out," as the patternmaker would say. To avoid this a wooden "mold-board" is built up and shaped in convex form to an exact counterpart of the concave surface of the proposed casting. Sheet lead, a very little thicker than the casting to be made, is formed over this by carefully beating it with soft pine sticks until the exact form is produced. To this lead form is attached any necessary parts made of wood, and the pattern is taken to the foundry and molded as it rests on the "mold-board," thus preserving its proper form. The casting thus produced is finished and used as a working pattern for regular productive work. This form of pattern is adapted to quite a large variety of work of this kind, and is very economical.

Patterns for Malleable Work.

Patterns for malleable iron work should be made of good material, such as cherry or mahogany, although first class pine is sometimes used. In some parts of the west butternut wood is very successfully used for this purpose. The requirements demand a grade of wood that may be readily "built up and dug out of the solid," and when so formed will hold its form without distortion, warping or checking. To facilitate the easy and thorough annealing of the castings no part of the pattern should be over ⅜ of an inch in thickness, and as the various strengthening webs and braces run in all directions without regard to the direction of the grain of the wood, the building up of the pattern requires much care and skillful workmanship, as well as the work of laying out and shaping it.

While cherry is an excellent wood to work, and possesses much strength yet its tendency to warp at most inconvenient and unexpected times renders it unsuitable for complicated patterns for malleable iron work.

One of the noticeable features of patterns for malleable iron work is that the proportion of dry sand cores is usually very small. Many of the wooden patterns for malleable iron work are reproduced in cast iron, brass, or white metal, the casting being then finished up for a standard pattern for regular use, as the frail wooden pattern does not possess sufficient strength to withstand the severe usage of the foundry for any great length of time.

Patterns for Automobile Castings.

The advent of the automobile developed a line of patternmaking that was, in some respects at least, new to the regular patternmaker. In a general way we may say that automobile patternmaking partakes in many respects of the characteristics of patterns for malleable iron, particularly as to the methods of building up the material, the manner of laying out the pattern and shaping it with hand tools, leaving thin and delicate ribs, webs and braces. In addition to these peculiarities there is a great deal of very nice core-box work. While all these parts are designed by the draftsmen and very accurate drawings furnished, the patternmaker must exercise much skill and judgment in designing the pattern, deciding how it is to be divided or "split;" how the material is to be built up and worked out; what part shall "leave its own core;" and what part shall have dry sand cores; how the cores shall be made, vented and set, and so on. All of these conditions show clearly that only skillful patternmakers with ample experience on comparatively small and accurate work should be employed on this class of patterns.

In considering the classification of patterns and pattern work with a view to its relation to the question of management and cost accounting, when the pattern shop is one of the

departments of an industrial establishment and we desire to adopt methods of handling its accounts of the expenses of time, material and fixed charges, it will be pertinent to glance at the methods of work in this department. The routine work of the pattern shop is quite different from that of any other department of the plant.

Qualifications of the Patternmakers.

We speak of skilled patternmakers as we would speak of a skilled machinist, or any other craftsman, and often without fully realizing the necessary and varied qualifications which such a man must possess in order to be a successful patternmaker. He must thoroughly understand the art of making a pattern. But this is not all, or even a great part of what he should know, not only of his own trade, but of other trades as well.

He should be able to read drawings readily and correctly. In addition to this qualification he should be able to make a plain drawing, since he must frequently use a drawing made on a small scale, while he lays out his work full size. Therefore he must be a fairly good and accurate draftsman as well as a patternmaker.

He must have a good and correct knowledge of molding the patterns in the foundry. This will include not alone green sand molding, but work in dry sand and prepared loam. He must also know the different processes of molding from the pattern, molds swept up by sweeps and strickles, in order that he may prepare this equipment in a proper manner when called for.

He must have a thorough knowledge of the behavior of various metals in the process of casting, particularly as applied to cast iron and the other ordinary metals in everyday use. This will include their percentage of shrinkage in castings of different forms and different metals; their liability to strain and to become distorted under varying conditions of form, size and proportion, when cast solid, and the influence upon them of dry and green sand cores of various forms.

Knowledge of Machinery Castings.

He should have such knowledge of the machine work necessary to finish castings, so as to enable him to make proper allowances for the amount of metal required for this purpose, according to the nature of the casting and the method of molding it. For instance, a small brass casting marked on the drawing as "file finish," will need 1/32 of an inch or less; a light iron casting, for planing, 1/16 of an inch; a heavy bed casting of iron having several planing finishes dependent upon each other may need anywhere from ⅛ of an inch to ⅜ of an inch, according to the shape of the casting and its liability to strain and distort. A small hole may need but ⅛ of an inch for boring out, while one from 6 to 12 inches may need from ¼ to ½-inch according to the form of the casting, the presence of other holes bearing a fixed relation to this one, and so on.

Knowledge of Various Grades of Lumber.

In a strict sense his knowledge of patternmaking as a trade, should include a knowledge of the different kinds of lumber when built up in a pattern, and the best methods of disposing the lumber so as to secure the greatest strength and rigidity. He must also take into consideration the effect of expansion and contraction of the wood under the alternate effects of wet sand, the artificial heat of the shop and the low temperature of the pattern storage room in winter. These changes are usually very severe tests of the structure of a pattern. He should possess good practical judgment of the proper place to divide a pattern when it is to be split so that the proper parts may come respectively in the cope and the drag of the flask, and also that the portion of the casting requiring to be of the most clean and solid metal may be always in the drag or lower flask, while the portion of lesser importance in this regard will be in the cope, or upper flask, whenever it is possible to so arrange it.

Thus it will be seen that the really skilled patternmaker must be a good mechanic and a man of varied attainments in his own calling and in those related to it in the routine of machine shop and foundry work. This naturally leads us to assume that he should be an educated mechanic and that the more thorough his knowledge of business, the more valuable his services will be, either as a workman, or a foreman.

Materials Used.

The materials used in patternmaking should be considered more at length than the brief mention that has thus far been made of them.

Of the different kinds of wood used in making patterns, the nine following are those most used and in relation to their usefulness and the relative extent of their use they will stand in the following order, namely: First, pine; second, cherry; third, mahogany; fourth, red cedar; fifth, butternut; sixth, whitewood; seventh, birch; eighth, maple; ninth, black walnut.

Usually the larger patterns, and in fact a very large majority of all patterns, are made of pine with small loose pieces, dovetails, exposed corners or fine moldings usually made of cherry. Clear pine, properly seasoned, is the best and safest wood for this work. A cheaper quality may be used for interior frames and supporting pieces, and in this lumber, small knots will do no harm.

Cherry.

Cherry is a very useful wood for pattern work, being strong and rigid, but in some cases it has a tendency to warp which detracts from its usefulness. It finishes up very smoothly, but is too hard to be easily worked when much hand cutting is required.

Mahogany.

Mahogany has long been a favorite wood for thin, light and accurate patterns for the reasons that it is light, easily worked, finishes up very smoothly and is not liable to warp. Its high cost, however, greatly restricts its use except for the higher grade of patterns upon which there is much very careful hand work.

Red Cedar.

Red cedar, sometimes erroneously called baywood or bay mahogany, is a very light, soft and easily worked wood and is not liable to warp, even if very thin webs are formed across, or at an angle with the grain.

Butternut.

Butternut is also a soft, easily worked wood, and in parts of the country where it is readily obtained is much used for patterns requiring much hand work. It is a good substitute for red cedar or even mahogany for many of the better kinds of light patterns. It is quite free from the difficulty of warping.

Whitewood.

Whitewood is not a very safe material to use on account of its liability to warp. If used, the softer varieties should be selected and it should be very thoroughly seasoned. It finishes up quite smoothly and should work about as easily as pine, while its cost is considerably less.

Birch.

Birch has a tendency to warp particularly if shaped into irregular forms by hand work. It finishes very smooth, but is not generally considered as one of the available woods for the patternmaker's use.

Maple is a hard, close-grained wood that finishes up very smooth, but has the same tendency to warp that lessens the utility of birch. In addition to this it is very hard to work by hand.

Black Walnut.

Black walnut is fairly free from the tendency to warp, particularly if the softer, straight grained varieties are used. It finishes up very smooth, but is too hard to be available for patterns requiring much hand work.

From the above it will be seen that the ideal wood for pattern work is one that is easily worked, fairly strong, finishes up smooth and above all things has the least tendency to warp. In selecting pattern stock we must, of course, be guided somewhat by considerations of economy, but this should not be carried so far as to lead to the attempt to make expensive patterns out of unsuitable lumber that may soon warp, crack and become worthless, and the expense of making the pattern be thrown away.

Metals Used for Patterns.

The metals usually used in the construction of patterns are cast iron, brass, white metal, lead, and aluminum. Cast iron being the cheapest of these metals is the more frequently used. The time required to finish patterns made of it is usually greater than with either of the other metals, and this frequently determines the use of brass or white metal, particularly for small patterns. The liability of a cast iron pattern to rust is overcome by warming it and coating it very thinly with beeswax. Brass is a very desirable metal for patterns as it is easily finished and very readily soldered so that in joining several patterns to a runner or gate, brass is a favorite metal.

White Metal for Patterns.

White metal is composed of zinc and copper, each 8 parts, tin, 28 parts, and antimony, 56 parts. For making patterns a similar metal is frequently made, omitting the copper and introducing a quantity of lead. This is, of course, a more economical alloy and for many forms of patterns answers the purpose equally well. One of these alloys is composed of tin, 16 parts, zinc, 11 parts, antimony, 13 parts, and lead 60 parts. Sheet lead is used in various ways principally to thicken up a pattern or to form over a mold board when the principal part of a pattern is to be a thin plate of curved surface.

Aluminum is an excellent pattern material, but on account of its high cost it is usually alloyed with zinc, to a large extent, sometimes as high as aluminum 10 parts, to zinc, 90 parts.

Use of Plaster.

Of other materials used in pattern-making, plaster is very useful for some purposes, although it is more used in the foundry than in the pattern shop. Leather is used in the form of cut fillets, usually purchased ready for use, and frequently to reinforce patterns or finished parts to be used as patterns. Straw board of various thicknesses is used for the latter purpose also. Beeswax is used to stop up small holes and in the cheaper grades of patterns to form fillets.

In this article a broad interpretation has been placed upon the subject discussed in order to present it in the comprehensive manner in which the manager and the accountant should consider it. While the subject matter is quite diversified there are yet many other matters pertaining to it that will be necessary to become familiar with in order to successfully manage this class of work and to properly account for the expenses incurred in its practical daily routine.

SEMI-STEEL MIXTURES AND METHODS OF CALCULATING THE CHARGES

BY M. B. SMITH

SEMI-STEEL as now made is a successful imitation of air furnace iron, and the idea of making it was undoubtedly derived from the air furnace. In the air furnace, cast iron loses a certain amount of carbon. If the silicon is not too low the castings are gray, fine grained and of great strength. The great strength is due largely to the low graphite. The lower sulphur of the air furnace also helps these finer physical properties. If we could lower the carbon in the cupola, we could get a similar metal. In the cupola the presence of the coke stops the lowering of the carbon, and the only way to diminish the graphite is to dilute the mixture with steel scrap containing very little carbon.

Origin of Semi-Steel.

In the air furnace, by burning out carbon and in the cupola by reducing the amount of carbon by large additions of steel, we make an iron which has more of the properties of steel; that is, it has greater strength and so the term arose, semi-steel. The ordinary semi-steel is very far away from true steel and it is hardly more than modified cast iron, but it is an approach toward steel, and the name holds.

There is a special semi-steel which is more deserving of the name. This steel is made with low silicon, low phosphorus, and low graphite, and has a larger percentage of combined carbon. This has greater wearing power, greater strength and resists shock or heavy blows better than the ordinary semi-steel. It has a greater shrinkage and greater hardness, and is more difficult to cast than the common semi-steel.

In both kinds of semi-steel we have the iron particles closer together with fewer flakes of graphite to separate them.

Chemical Mixture.

The statement is made that semi-steel is a mechanical mixture of steel and cast iron. This is far from true; the mixture is not mechanical but chemical. The steel has taken on carbon, silicon and phosphorus, and has united with the cast iron as part of it. The union is as complete as the union of carbon with iron in steel.

At one of the large foundries there were some semi-steel castings with spongy tops. The remark was made that the steel had settled to the bottom while the lighter cast iron had risen to the top, and the observer declared that semi-steel was impossible on account of the different gravities of the two metals. Anyone familiar with semi-steel knows that such

separation never occurs, and that the spongy top was due to insufficient feeding, or the pouring of cold metal.

Methods of Making Semi-Steel.

There are numerous ways of making semi-steel, and it is common to see makers surrounding their methods with a certain amount of mystery. Some claim that the highest percentages of steel give the best results and 40 and 50 per cent steel are quoted as giving fine results, but the general practice is toward low amounts of steel. Ten, 20 and 25 per cent are commonly added, and there is apt to be trouble from larger amounts than 25 per cent.

A Representative Analysis.

A good composition for semi-steel of the ordinary kind, looking merely for density and strength, follows:

	Per cent.
Silicon	1.80 to 2.00
Sulphur	0.06 to 0.10
Phosphorus	0.65 to 0.85
Manganese	0.85 to 0.95
Graphite	2.30 to 2.40
Combined carbon	0.80 to 1.00

Metal for Great Strength.

To make a metal that will show strength and also resist wear and heavy shocks, this composition is used:

	Per cent.
Silicon	0.90 to 1.00
Sulphur	0.04 to 0.06
Phosphorus	0.15 to 0.30
Manganese	0.60 to 0.70
Graphite	2.40 to 2.60
Combined carbon	0.80 to 1.00

In the first analysis the silicon is high. Two per cent silicon is about right, and the metal will show very little more shrinkage than ordinary cast iron. The high phosphorus promotes fluidity and the manganese is sufficient to remove the effects of oxidation. Nothing is gained by higher percentages of manganese. There is no need of any aluminum if 0.85 per cent of manganese is present. This is the semi-steel largely used and is frequently made with 25 per cent of steel scrap. In the second analysis the silicon and phosphorus are low. This metal is much more like steel. It has great shrinkage, is tougher, will stand wear and abuse better than the high silicon metal. It has low fluidity, owing to the low phosphorus, must be poured very hot and requires large gates and risers.

A little aluminum might benefit the pouring of these castings, but it is seldom used. Ferro-titanium would be better, but little has been tried with semi-steel. With the low silicon there is danger of the iron going white, and for this reason the silicon must be kept close to 1 per cent or above.

Mixture for High Silicon Semi-Steel.

The mixture for high silicon semi-steel is made up as follows: 25 per cent steel scrap, 15 per cent cast iron scrap, 20 per cent high phosphorus pig, 40 per cent high silicon pig.

The steel scrap can be boiler or tank plate, structural steel or steel rails. It should be fairly heavy. Sheet steel, needle like clippings and turnings should be avoided, as they oxidize quickly before melting. Steel boiler plate punchings are good, but they must be distributed well, not charged in the center of the cupola.

Steel plate ¼ to ½ inch thick is considered good stock. This is cut in one and two-foot lengths. Short lengths of steel rails are the most satisfactory. The steel should be charged upon the coke, followed by the pig and scrap. The quicker melting pig and scrap drops in the partly melted steel, carbonizing it and making it more fusible.

For a 10 per cent steel mixture, the melting ratio is the same as for ordinary cast iron. For higher percentages the coke must be increased. The iron must be hot. Most of the trouble in making semi-steel is due to lack of heat. The amount of coke must be raised if necessary to make the iron hot. The percentage of sulphur is reduced by running hot iron and the semi-steel is better.

Calculating Mixtures.

A simple way of calculating the semi-steel mixture is as follows:

	Per cent of silicon in pig iron and scrap.		Per cent of silicon in mixture.
40 per cent high silicon pig iron	3.10 x 0.40	=	1.24
20 per cent high phosphorus pig iron	2.30 x 0.20	=	0.46
15 per cent cast iron scrap.	2.00 x 0.15	=	0.30
25 per cent steel scrap	0.04 x 0.25	=	0.01
Total silicon in the mixture		=	2.01

	Per cent of phosphorus in pig iron and scrap.		Per cent of phosphorus in mixture.
40 per cent high silicon pig iron	0.65 x 0.40	=	0.26
20 per cent high phosphorus pig iron	1:50 x 0.20	=	0.30
15 per cent cast iron scrap.	0.60 x 0.15	=	0.09
25 per cent steel scrap	0.08 x 0.25	=	0.02
Total phosphorus in the mixture		=	0.67

In general practice the silicon and phosphorus in steel is so low that the amount added to the mixture is not calculated. The manganese in this mixture will amount to 0.50 per cent. To bring the mixture up to 0.80 per cent, it will require about ¼ of 1 per cent of ferro-manganese, allowing 0.20 per cent waste in melting. This is best added by charging it in lump form in the cupola. Spiegel-eisen is very good for semi-steel, but four times the quantity is needed. At present prices, it is more economical to use ferro-manganese.

In making out the cupola sheet, it would be well to subtract the few pounds of ferro-manganese from the steel scrap used.

The cupola sheet calculated on a total charge of 5,000 pounds for a cupola 66 inches diameter would be as follows:

First charge—Bed coke, 2,500 pounds; high silicon pig iron, 2,000 pounds; high phosphorus pig iron, 1,000 pounds; iron scrap, 750 pounds; steel scrap, 1,215 pounds; ferro-manganese, 35 pounds; limestone, 400 pounds.

Second charge—Bed coke, 600 pounds; high silicon pig iron, 2,000 pounds; high phosphorus pig iron, 1,000 pounds; scrap iron, 750 pounds; steel scrap, 1,215 pounds. ferro-manganese, 35 pounds; limestone, 150 pounds.

The low silicon semi-steel is made with one or two low silicon, low phosphorus irons, using little scrap and 20 per cent of steel. This variety must be run hotter than the other as there is little phosphorus to give fluidity. This will make a fine metal for rollers and will stand rough usage.

These two semi-steels are an improvement over ordinary cast iron. They approach the air furnace iron in most respects and excel it in strength.

Foundrymen have been very cautious in the use of steel, but now are beginning to use it with more freedom. With the following points in mind semi-steel can be made that will prove satisfactory:

First—Don't use over 25 per cent steel. Good mixtures are made with 10 and 12 per cent steel.

Second—Have the metal hot when poured.

Third—Keep the manganese well up.

Test bars, 2 x 1 x 24 inches of 20 per cent semi-steel made in this way show 2,800 to 3,000 pounds transverse strength with 7/16-inch deflection.

THE USE OF PITCH.

By T. Shaw

The application of pitch to dry sand molds or large cores just after they have been removed from the oven will generally result in a very clean casting, free from seamy streaks so often seen on rolls. The pitch is readily absorbed by the hot mold or core, fills up the rough surfaces and when cooled the mold can be easily given its coat of blacking. The pitch acts as a cushion between the mold and blacking and the casting will require very little cleaning.

MOLDING A STEAM CRANE CYLINDER

Making a Casting Which Involved Many Difficulties Both in the Pattern Shop and Foundry

BY JOSEPH HORNER

THE ILLUSTRATIONS, Figs. 1 to 4, show a cylinder of which hundreds have been made for a vertical type of steam crane. The peculiar form of the steam chest, projecting out from the body and upwards towards the top end of the cylinder, is due to the relative positions of the cylinder and the valve gear. The cylinder is bolted outside the crane cheeks, and the chest passes within the cheeks to get the valve gears. inside. The chest is placed high up to clear a roller girder within the frames. The feet A A are bolted to the frames and the exhaust branch B is made right and left hand for a pair of cylinders.

Parting the Mold.

Fig. 1 illustrates the casting in plan, Fig. 2 in elevation looking against the face of the steam chest, Fig. 3 is a horizontal section through the exhaust passage, and Fig. 4 is a vertical section through the axis of the cylinder. The special point to note in molding is the position of the joints. There must be a box part joint along the plane c c, Fig. 3; another box joint along the face d d of the steam chest flange, rendering a three-part box necessary. There must also be a pattern joint along e e, otherwise the chest would not deliver; and a sand joint at f f, or the flanges A A could not be gotten out. We might solve the problem by coring out behind the steam chest, and behind the flanges A A, bringing prints out at the sides to carry the cores.

The Pattern.

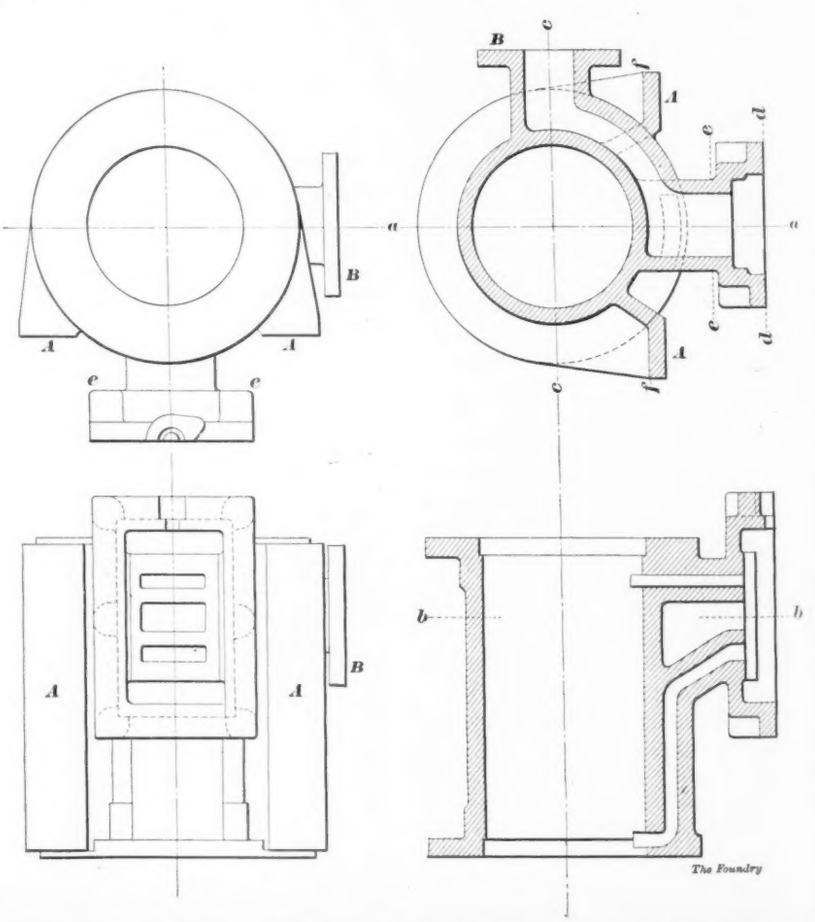
This would be expensive, but is an alternative. The patterns for this type of cylinder are made as shown in Figs. 5 to 8, and molded in the manner illustrated in subsequent sketches. The sand behind A A is carried on drawbacks. The sand behind the steam chest flange is carried on a ring form of drawback, or lifting plate.

The pattern shown in Figs. 5 to 8 is jointed at c c and e e. The lagging up is shown, and the various arrangements of grain show how the lumber is prepared and put together. The steam passage block is fitted to the cylinder body, and the jointing face e e is checked to be parallel with the body joint c c by means of a straight edge and rule. The steam chest is doweled to the passage block along the plane e e, and the flanges A A are made in one piece with their bracketings, and screwed on the body temporarily. The screws are inserted from within the body through the lagging, and removed when the ramming up is completed. The exhaust passage block is fitted in three pieces, separated by the joint c c, and by one of the feet A. All flange faces must be either parallel or square. Head metal is allowed as shown. The core boxes for steam and exhaust are shown in Figs. 9 to 11, and require no explanation.

First Molding Operation.

The first stage of the molding is shown in Figs. 12 and 13. One-half the pattern is laid on a bottom board with the middle part box surrounding it. Two drawbacks, a a, are laid next to the flanges A A. They have iron rods cast in as shown, projecting inside the flanges to carry the sand there. As the drawback plates are not required to fill up the joint face, which would also make them heavy for handling, they are propped up temporarily on bricks b b, or anything handy. Sufficient sand (dry sand mixture) is tucked around to steady the drawback blocks, and to afford a joint face, f f, as shown in Fig. 3. The permanent ramming in of the drawbacks is done after turning over.

On the face f f, the first portion of the actual mold is rammed, coming up over the flanges A A, and against the passage blocks B, support being af-



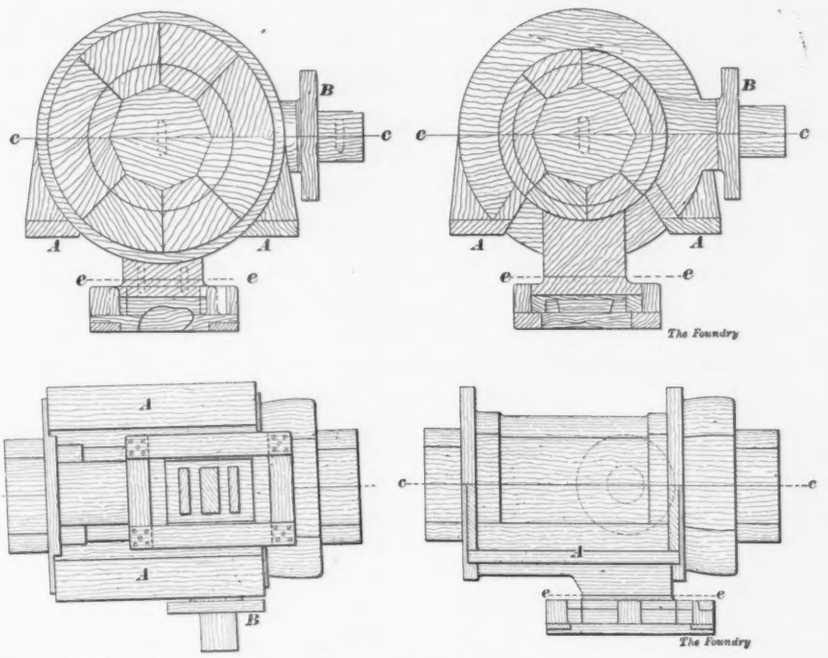
FIGS. 1, 2, 3 AND 4—PLAN, ELEVATION, SECTIONS B B AND A A OF CRANE CYLINDER

forded to the sand by rods and nails. This comes up to the joint face e e, Fig. 3. On this another portion, a flat thickness, is rammed on a rectangular frame, Fig. 14, cast with rods to sustain the sand, and having two eyes by which to lift it. A joint is strickled around the face of this cake of sand by working a strickle from the steam chest flange, shown at C in Fig. 15, the object of which joint is to permit of the putting back of this portion into the bottom box later. Fig. 15 shows this work superimposed on that shown in Fig. 12. The bottom box is now rammed on this joint face, Fig. 15, D, and the two-part mold is turned over to receive the top box, as shown in Fig. 16. Before this is put on and rammed, the drawbacks *a a*, are lifted out, and the sloping joints roughly made between them and the drawbacks are replaced. Sand is then rammed up as required between them and the pattern body and over them right up to the joint face of the molding box, and all strickled off flush and parted. Then the top box is laid on and rammed as shown in Fig. 16, completing the ramming. All this is done in dry sand.

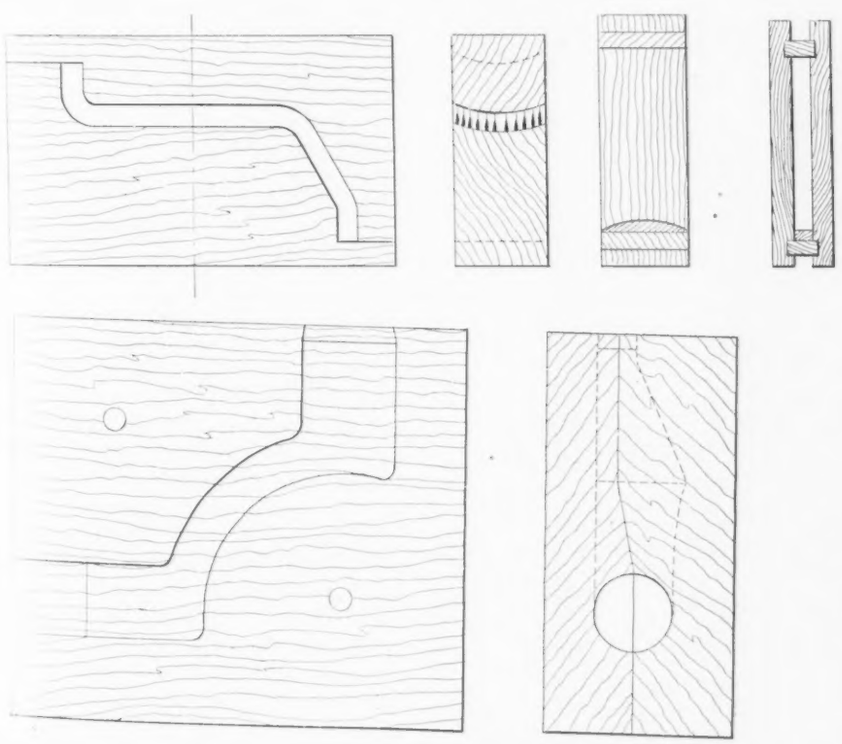
Drawing the Pattern.

The pattern parts are next drawn. The top half delivers freely. The bottom parts come out in sections. First the screws by which the feet A A are attached to the body are taken out, and the body withdrawn. The drawbacks are next lifted, leaving the way clear for the removal of the feet A A. The portion still left is the steam chest. To remove this the middle part box is lifted off, followed by the ring of sand, leaving the steam chest exposed, having its flange thickness and its interior with the core print impressions, in the bottom box, into which the passage cores can be inserted after the drying and cleaning of the various sections of the mold.

The coring up is shown as it appears in longitudinal section in Fig. 17. The passage cores go in before the body core. The short core *a* is supported entirely by the bottom print; *b* is carried in its bottom print at one end and in the print of the exhaust flange at the other, as shown in Fig. 18; *c* is carried in its bottom print, and supported at the other end by a chaplet, or nails. Before the main core is put in, the thicknesses between *b* and *c* are tried, and also the contact of *a* and *c* with the body core, using a straight edge from print to print, whiting, or clay thickness pieces, according to requirements. The mold is up-ended for pouring through the head metal, for which holes are provided in that end of the box.



FIGS. 5, 6, 7 AND 8—SECTIONAL VIEWS AND ELEVATION OF CRANE CYLINDER PATTERN



FIGS. 9, 10 AND 11—CORE BOXES FOR STEAM AND EXHAUST CORES

A MEMORANDUM ON TEST BARS.

Question:—The data sheet published in the January number of THE FOUNDRY is valuable to every one who uses castings or makes them. To the former it furnishes a standard by which to judge of the quality of the material which he can reasonably expect to get and it does much more for the foundryman. It gives him a standard by which to judge his own output and also one by which to judge of the reasonableness of any specifications which he may receive.

We are making patterns and are preparing to make bars of the size the specifications call for so that we can see how they compare with our regu-

lar bars. The bars which we have been using are 1 inch square and the supports are 12 inches from center to center. We think that after making some careful comparisons with the different shaped bars when cast from the same iron we should be able to judge how our iron, as shown by our records of bars, has been running in the past, as compared with the new standard. If several thousand records of square bars can be made comparable with what would have been obtained if the new standard round bar had been used it will increase their value.

There is another point to which these specifications direct attention. While it is not recommended for regular use yet under some conditions a test for tensile strength is provided for. Even if it is never called for most of us would like to know what it is for our mixtures, but most of us are without any means of making such a test. Most foundry companies seem to feel that they have been liberal when they provide a machine for making transverse tests, and very few foundry foremen have work enough to justify the outlay for an elaborate testing machine oven if they could get one.

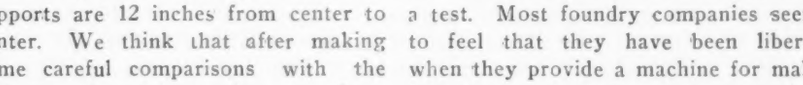


FIG. 12—FIRST MOLDING OPERATION

Is there any way that the tensile strength can be figured from the transverse strength, or from a combination of the transverse strength and the deflection?

From the formula given for the strength of beams it would seem that it could be, and I have been told by some mechanical engineers that such is the case but on pressing the matter I find that they base their statement on information derived from their text books and not on practical experience with cast iron.

Strength of Steel Beams.

A wrought iron or steel beam very seldom breaks under a load because it will deflect beyond working limits long before it will break and the designer must keep the deflection within limits. The formula may be very true within the limits of regular work and on some material but the results which I have obtained when trying to figure the tensile strength from them for cast iron, using the transverse breaking load as a starting point, has given me results too good to be true. If I take the tensile strength which good cast iron should have as the starting point, and try to figure the weight at which bars should break, the result gives me a weight much lower than that at which the bars break.

Relation Between Tensile and Transverse Strengths.

It seems reasonable to suppose that there is a direct relation between the tensile and the transverse strengths of material, because as far as my experience goes, a metal beam always fails by being torn asunder and never by crushing. With the neutral axis always passing through the center of gravity, which text books declare it always does, it should be possible to prove what this relation is if one had both a tensile and transverse testing machine at hand.

There is another point that has been bothering me. Will the transverse test tell anything about what an iron will stand in the way of a blow?

I understand that a machine has been made and used in investigations

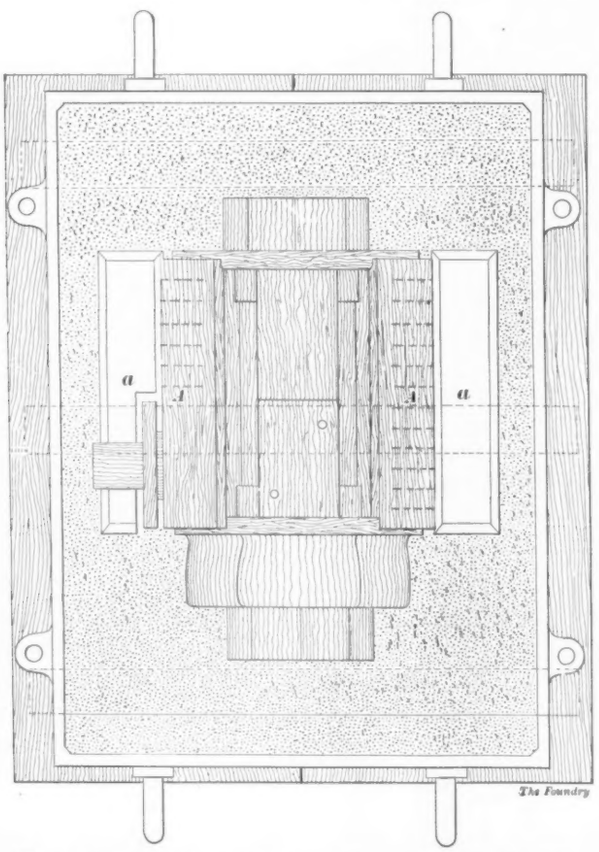


FIG. 13—PLAN VIEW OF PATTERN ON BOTTOM BOARD

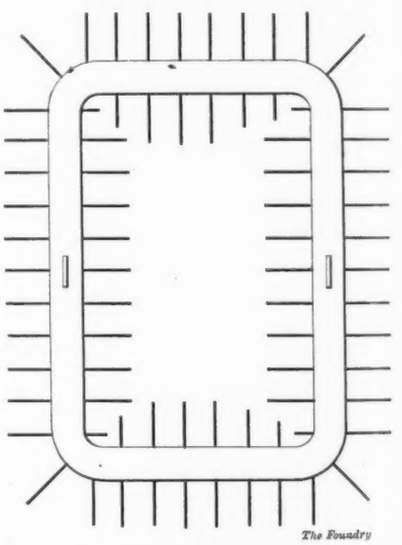


FIG. 14—CAST IRON FRAME PROVIDED WITH RODS

which in some way registers the force used as a blow in breaking cast iron. From what I have heard of it I should think that it is not a machine likely to come within the reach of a foundry foreman, yet it may tell many things which it would be well for him to know.

While I have never seen it so stated, I have thought that a bar with a large deflection would withstand a harder blow than one that broke with the same load but with a smaller deflection. When a friend called on me for proof of it I could not produce any. I could not even tell him what the deflections of a bar did show beyond the fact that it bent that much before breaking.

All of the information asked for may be an old story, and there may be many who will be surprised to find a man in charge of a foundry who is not better informed. I know that a test bar that holds up 2,600 pounds before it breaks, holds up more than one that only holds up 2,200 pounds, but I am not sure which is the strongest bar. I wish I did know, and this is written in the effort to stir up the man who does know and get him to tell it in a way that I can understand. OSCAR W. BURNS.

Answer.—I was very much interested in what Mr. Burns asks about test bars, and as I had the pleasure of working with my other foundry friends on the specifications for testing cast iron, a few comments may not be amiss.

The round, 1¼-inch bar was selected as being best calculated to fill the requirements of the case without too much interference with foundry practice. The square bar has the disadvantage of four hard corners. The bar cast flat is stronger when tested one way than the other. Green sand is liable to introduce errors not found with a dried mold, etc. Mr. Burns' idea of testing a lot of new bars in connection with 1-inch square bars to establish a relation is a good one for his own shop and line of work. There is no objection whatever to using the 1-inch square bar for one's shop tests, as it is possible to keep a record that way. When, however, it comes to a show down as between the man who buys under strict specifications, and the man who makes castings and happens to miss it, the decision can only be left to tests on bars as nearly perfect as they can be made and still be practical commercially. It is then up to the maker to know whether his material can pass this "arbitration" bar before he makes his bid and does his work. As more and more works are coming to adopt the round bar as specified, we will gradually get accustomed to it, and the future will see the general adoption of the standard.

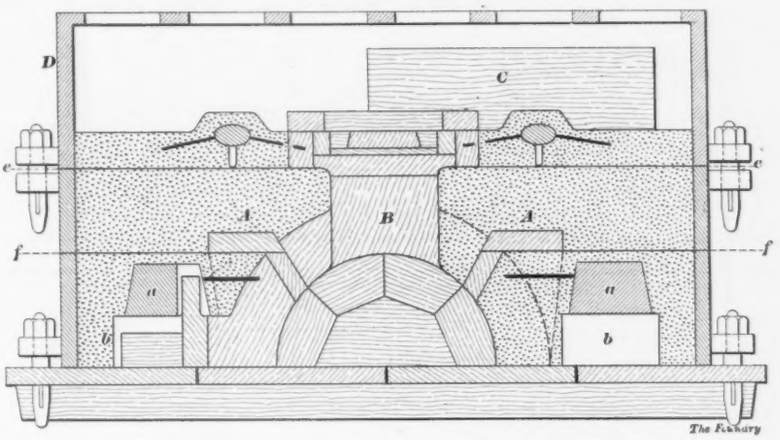


FIG. 15—PROGRESS OF THE MOLDING OPERATION

Tensile Test.

The tensile test is not a good one for cast iron, not because the information is not useful, but because it is almost impossible to conduct a proper tensile test for cast iron. The ordinary machines with the wedge grips never catch the bar so that it is held equally fast on all sides at one time. The slightest slip on one side of a bar and side strains comes in, and a part transverse and part tensile tests result with several thousand pounds per square inch strength sacrificed. Hence, the specifications call for the bar specially prepared, with screw ends, etc. This costs money and no ordinary foundry can be expected to pay for it. Germany has abandoned the tensile test for cast iron altogether. We reluctantly kept it, but put the cost on the man who wanted it.

Figuring the Tensile Strength From the Transverse.

It is of course possible to figure the tensile strength of cast iron from the transverse, but it will not be correct. Cast iron is not a homogeneous substance. Even steel is not, but the latter is golden compared to cast iron.

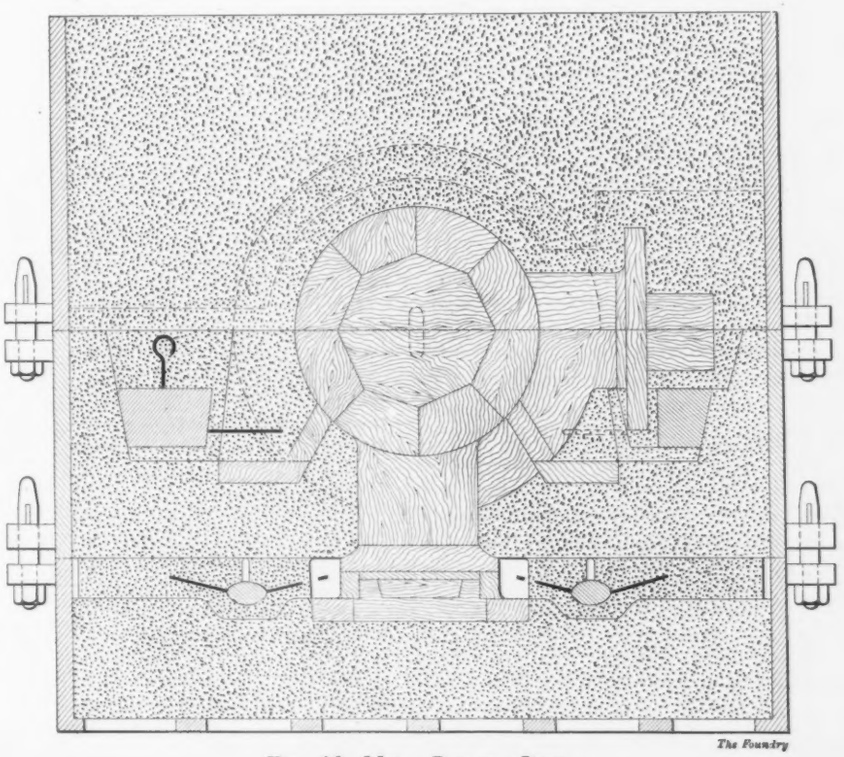


FIG. 16—MOLD ROLLED OVER

Therefor, one cannot fit the results of one test to another. In a measure, however, one gets a sort of fair idea of what is going on, but no more. Much depends upon the size of the bar on which the calculation is made. With a small section, the tensile test will give abnormally high results, which applied to a transverse test by calculation make the figures appear wrong. Take a large tensile test specimen, and it is not so bad. The trouble, however, is that few testing machines can take a large tensile specimen.

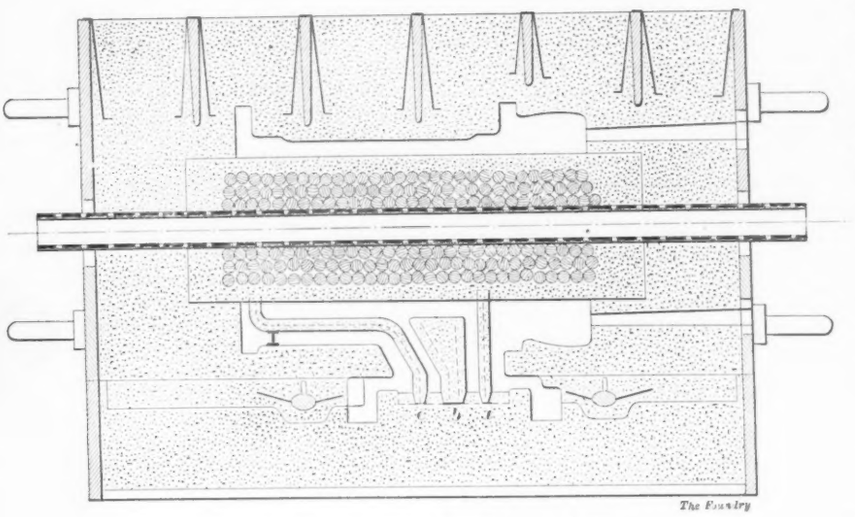


FIG. 17—METHOD OF SETTING THE CORES

Impact Machine.

Now as to resistance to shock. There are new machines built for this purpose, called impact machines. But as yet these are experimental and are located at the universities. Some day they may become commercially useful. We are certainly looking for this to happen. For the present we are getting our information in this direction, called the "resilience" of cast iron, by calculation entirely. The breaking weight, deflection and weight of bar between supports, are part of this formula, devised by the late Prof. Johnston, and fully explained in his book. With the same sized bars, tested the same way this is a fairly comparative method, and one may learn something about the resistance to shock on the part of cast iron, provided the same kind of cast iron is used throughout the tests. Here again we meet the non-homogeneity of cast iron.

In conclusion I may say for the foundry experts, of whom I count myself one of the least, that we thoroughly sympathize with Mr. Burns. We do not at all think that he is a poor foundry foreman because he is not satisfied with what the books tell him about steel when he applies it to cast iron. Neither are we. Foundry experts find a whole lot that they wish they knew, and only the man who is looking for more light has a right to feel that maybe he knows a little.

So cheer up, brother Burns. There are others who do not know whether the 2,600-pound bar is stronger than the 2,200-pound bar. Much depends upon the point of view, and in the foundry business a man can claim most anything and argue himself as right.

RICHARD MOLDENKE.

CASTING NICKEL.

BY C. VICKERS

Question:—I have made a number of attempts to cast nickel in combination with other metals, especially copper, but have experienced great difficulty in preventing the castings from becoming more or less porous, and also have trouble in getting the metal to run freely, except at a very high temperature. It would seem that while the ordinary flux used in composition castings will cause the nickel to flow more freely, it does not prevent them from coming out porous.

Answer:—You will have to use aluminum in your nickel alloys. Use two ounces of aluminum to 100 pounds of metal and if not sufficient increase the aluminum until the alloy casts well. Be careful not to use too much aluminum, as the alloy will shrink enormously and it will be correspondingly difficult to cast.

HIGH TENSILE BRONZE ALLOY.

Question:—We would like to have a mixture for a bronze alloy that will have a tensile strength of 25,000 pounds. This is to be used for casting bolts ¾ inch in diameter and 5 inches long.

Answer:—Try the following alloy: Copper 90 pounds, zinc 4 pounds, tin 5 pounds, lead 1 pound.

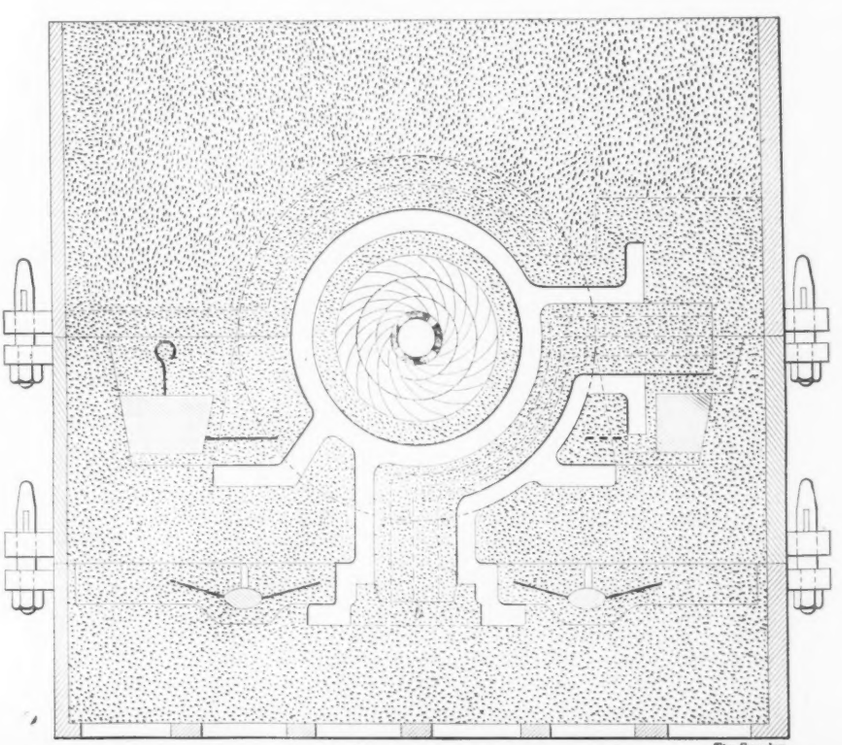


FIG. 18—CROSS SECTION OF THE CLOSED MOLD

PRODUCTION OF MALLEABLE CASTINGS-V

Mixtures for Making Various Grades of Malleables and Methods of Calculating the Furnace Charges

BY RICHARD MOLDENKE

ORDINARILY a malleable works has but one mixture running at a time. Where, however, attention is paid to the niceties of the art, and customers are given more nearly what they should have, especially with the open-hearth furnace, several mixtures may be run right along.

For instance, taking the most advanced practice, every time an open-hearth furnace has been rebuilt and heated up preparatory to making malleable, it is advisable to run a "pill heat" through it. This, pigged for subsequent use as sprues, merely serves to get the furnace into proper working shape, and tells the melter if everything is working properly about his furnace. It forms a sort of insurance for good malleable next time.

Again, running over Sunday, the furnaces are apt to be a little colder than they should be, and hence a "Monday morning heat." Then of course the "regular heat" of daily practice. When a good customer wants specially soft iron, a "special heat" is made which contains no steel scrap, and is higher in silicon than the ordinary mixture. The castings are by no means as strong, but they thread and machine nicely.

Next comes a "pot mixture," run in either the air, open-hearth, or cupola furnace. In the case of the cupola, less silicon is burnt out, hence the mixture is arranged accordingly.

"Sprue heats" are sometimes made when things go wrong in the works, in this case pig iron only as a rule forms the material melted.

It will be seen, therefore, that mixing can be made a fine art; and yet once the principles of the operation, as explained in the previous chapter so far as the materials used are concerned, are understood, the work is so simple that every foundryman can master the details in short order.

Calculating a Mixture.

Commencing then with the regular mixture. Take first an easy one from the old days of charcoal iron, with no scrap other than the regular sprues. The work required consisted of couplers, the silicon wanted was 0.55 per cent in the mixture, to give from 0.30 to 0.40 per cent in the castings. Here is what was used:

Brand.	Amount, pounds.	Silicon in brand, per cent.	Silicon in mixture, pounds.
Pioneer, No. 2.....	2,000	0.90	18.0
Elk Rapids, No. 2...	1,000	1.00	10.0
Antrim, No. 2.....	1,000	0.76	7.6
Hinckle, No. 3.....	2,000	0.77	15.4
Antrim, No. 3.....	2,000	0.76	15.2
Pioneer, No. 3.....	1,000	0.61	6.1
Hinckle, No. 4.....	1,000	0.48	4.8
Sprues	9,000	0.30	27.0
Total	19,000		104.1

Or, every thousand pounds carried 5.5 pounds of silicon, or in other words the mixture 0.55 per cent. Now, in running about 10 heats a day in 10-ton furnaces of the open-hearth type, the resulting castings contained 0.35 per cent silicon and annealed first class. This mixture is given merely to show how low in silicon one can go and still get good work, provided the heats are quick, charcoal irons are used, and only domestic sprues enter the mixture. There are some works still so situated that they can use the above, or the equivalent, for their heavy castings.

Mixtures Under Modern Conditions.

Turning to more modern conditions and studying the method of mixture calculation at the same time, let us consider, for instance, the following points as fixed. The silicon wanted in the mixture to be 0.80 per cent, so that when melted and cast the work may turn out about 0.50 per cent (for fairly heavy work), 21,500 pounds to be used to the charge (for 10-ton furnace running under pressure of work); 250 pounds of each steel and gray iron scrap to be in the mixture, as well as 3,000 pounds of malleable scrap; the percentage of sprues at the time being 8,000 pounds, thus keeping the sprue pile normal. These are conditions imposed upon the plant by the supplies on hand. It will be seen that in order to use that much iron in the furnace—its maximum at the time—with the steel to improve the metal, and the gray iron scrap to get rid of that amount on hand, and 3,000 pounds of malleable scrap which takes care of the supply of that material coming in at the time, only 10,000 pounds of the charge is pig iron, or a little less than one-half.

With 21,500 pounds of metal to contain 0.80 per cent silicon, the total silicon in the mixture must be 21,500 × 0.80, or 172.0 pounds. Taking first the fixed conditions of scrap, we have:

Pounds.		Pounds.
8,000	sprues (containing by analysis 0.50 per cent silicon).....	40.0
3,000	malleable scrap (estimated 0.40 per cent silicon).....	12.0
250	steel scrap (estimated at no silicon).....	....
250	gray iron scrap, heavy (estimated at 1.00 per cent silicon).....	2.5
11,500	metal, containing silicon	54.5

This leaves 21,500 minus 11,500, or 10,000 pounds of pig iron with 172.0 minus 54.5, or 117.5 pounds of silicon to be provided to bring the mixture out right. Looking over our pig iron sheets we find that it is desirable to cut down the quantity of "D," "B," and "N," so we take say, 2,000 pounds of each, and have:

Pounds.		Pounds.
2,000	"D" (Antrim, with 1.00 per cent silicon).....	20.0
2,000	"B" (Spearman, with 1.25 per cent silicon).....	25.0
2,000	"N" (Mabel, with 1.25 per cent silicon).....	25.0
6,000	metal, containing silicon	70.0

Adding this to the above we have now 17,500 pounds of metal with 114.5 pounds of silicon provided for, leaving 21,500 minus 17,500, or 4,000 pounds of pig iron, with 172.0 minus 124.5, or 47.5 pounds of silicon still to be added.

We come now to making combinations with what we have left in the yard to get these 4,000 pounds of pig to contain as nearly as may be the 47.5 pounds of silicon. In the particular mixture in question, this proved to be the following:

Pounds.		Pounds.
3,500	"G" (Briar Hill, with 1.25 per cent silicon)	3.7
500	"K" (Ella, with 0.75 per cent silicon)	43.8
4,000	metal, containing silicon	47.5

Thus, adding all the metal together, it happens we hit the exact amount, which is rather exceptional, usually a variation of a few pounds of silicon is unavoidable. Tabulating the several items we have the following:

Brand.	Amount, pounds.	Silicon in brand, per cent.	Silicon in mixture, pounds.
"D"	2,000	1.00	20.0
"B"	2,000	1.25	25.0
"N"	2,000	1.25	25.0
"K"	500	0.75	3.7
"G"	3,500	1.25	43.8
Sprues	8,000	0.50	40.0
Malleable scrap	3,000	0.40	12.0
Steel scrap	250	....	....
Gray iron scrap	250	1.00	2.5
	21,500		172.0

Dividing the 172 by 21,500, we get the silicon of the mixture 0.80 per cent.

The Castings.

This mixture gave castings with 0.50 per cent silicon, which annealed all right. It was used in all the morning heats for 10 furnaces. For the afternoon heats, as the furnaces were much hotter, occasionally the silicon had to be cut down a little and the silicon of the mixture made to run 0.75 per cent. On the other hand for Monday morning all the furnaces were charged with a mixture running 0.85 per cent. Thus, with a silicon basis established in a works, it is easy to vary the mixture for the same furnaces, using the same tonnage, and provide for the peculiar heat conditions obtaining. This can be done with the air furnace as well as with the open-hearth.

Limited Number of Brands.

To show that it is by no means necessary to have a number of brands in a mixture, though advisable to pile the metal according to analysis, many cars on one pile, the following mixture is appended, which gave very strong and good castings:

Brand.	Amount, pounds.	Silicon in brand, per cent.	Silicon in mixture, pounds.
"O" (Mabel)	8,000	1.00	80.0
"E" (Mabel)	3,000	1.25	37.5
Malleable scrap	2,500	0.40	10.0
Steel scrap	500	....	....
Sprues	7,500	0.55	41.2
	21,500		168.7

Dividing 168.7 by the 21,500 pounds of metal we have the mixture containing 0.78 per cent of silicon, and only one brand of pig iron used.

The making of special heats is carried on just as the above example. It may be desirable to leave out the steel or reduce the malleable scrap or in some other way attain the desired result. When a new iron is to be tried, the method shown in the last example should be followed out. That is to retain the sprues, scrap, steel, etc., and substitute for the pig iron as much of the new iron as can be gotten in without upsetting the silicon balance. Cast the heat, and collect all the sprues for the next heat with the new iron. This will sufficiently impress the resulting castings, and by the strength of the test bars made, a very fair idea of the value of the new iron obtained.

Making Annealing Pots.

In making annealing pots it is advisable to use only the best of materials, though occasionally much has to be put in which will not do very well in the regular mixture. Thus the scrap pots are often cut up and melted in the cupola, and very thin annealed material which may have been badly rusted is sent through the cupola. The last is all right, but the first, or scrap pot, had better be sold to the blast furnace again, as it is badly oxidized, and always makes inferior pots which soon burn out. Here is a mixture for the cupola for making annealing pots:

		Pounds.		Pounds.
"N"	(Mabel, with 1.25 per cent silicon)	2,000	with	25.0 silicon
Malleable scrap	(0.40 per cent silicon)	3,000	with	12.0 silicon
Charge		5,000	with	37.0 silicon

or 0.74 silicon in the mixture.

As a general rule, where there are enough furnaces to take care of the current work, all extra iron is cast into annealing pots, and thus the cupola is used only occasionally. While this is convenient it is not altogether advisable, as in the first place the air furnace or open-hearth iron costs more, and cupola iron though inferior in strength as malleable when annealed, will withstand high temperatures better, being much closer in structure. It is therefore better to run the heats close to the floor requirements, and to start the cupola so many days a week as may be required for the supply of pots and stools.

"Pill Heat."

There remains only the so-called "pill heat," the pigs from which, if the furnace worked properly, are so much "sprues." If the furnace showed signs of trouble, this would have to be corrected before going any further.

Here is a mixture for this purpose:

		Pounds.		Pounds.
"T"	(Briar Hill 0.75 per cent silicon)	10,000	with	75.0 silicon
"X"	(Excelsior 1.00 per cent silicon)	6,000	with	60.0 silicon
		16,000	with	135.0 silicon

The silicon in the mixture is 0.84 per cent. It will be noted that the silicon is fairly high, and the amount of the charge smaller than the capacity of a 10-ton furnace, the only object being to get a newly built, or rebuilt furnace into proper working conditions.

Once in a while, the bottom of a furnace gets high and in bad condition, and rather than tear it out and thus put the furnace out of commission for a while, a small heat of the worst iron available is charged and deliberately burned. The oxide of iron thus fromed cuts the sand bottom, and the slag running off leaves it in the shape for building up again. Limestone is also used in this way, but requires great care as it is very active on a sand bottom.

Conclusions.

In conclusion it may be said that close attention to the scrap piles, the mixture requirements to make the proper classes of malleable, and the buying of irons to keep the minimum of metal piled up in the yard without being caught unprepared through slow deliveries, constitute the art of getting results without having to resort to the purchase of cheap irons which mean bad malleable every time. A good laboratory, and still better a good metallurgist pay over and over again in a malleable shop even with an output as small as 10 tons a day of finished castings.

It is understood, of course, that where a works requires a silicon higher than the examples cited, the mixture is arranged accordingly. The mixtures quoted happen to be actual ones giving fine results and have been selected in view of the tendency existing to use too much silicon for malleable castings today, partly through fear of getting it too low, and also through ignorance of the fact that the lower ranges give the strongest metal.

A MODEL CANADIAN BRASS PLANT

Works of Somerville, Ltd., Toronto, Which Have Been Built With Many Provisions for the Welfare of the Employes

IN EQUIPMENT, the convenient arrangement of its various departments, and the provisions that have been made for the welfare of its employes, the new brass plant of Somerville, Ltd., Toronto, is a model factory of its kind.

Arrangement of the Plant.

The works are built on the unit system and consist of a machine shop and finishing department, lead trap and pipe plant, brass foundry and boiler and engine house. The main building in which are located the machine shop, buffing and grinding room, plating and shipping departments, is a two-story and basement structure, 60 x 175 feet. It is of standard mill construction, having brick curtain walls, and is provided with automatic sliding fire doors between every department. On the first floor are located the main office, plating and buffing room, stock room, receiving and shipping departments, together with a large pattern vault 20 x 12 feet. The entire second floor, with the exception of the superintendent's office, is occupied by the machine shop. In the basement is located the lavatory, which is a model in appointment. It is provided with shower baths, porcelain wash bowls and individual lockers for all of the employes. In addition, drinking fountains have been placed in every department and every arrangement and provision have been made to insure proper sanitation.

Features of the Main Building.

One of the features of this building is the superintendent's office, which is enclosed by glass on all sides and is located to command a full view of the machine shop, pattern room and foundry. All of the partitions between the various departments are made of wire glass. The windows of the ground floor are situated six feet above the street level so that no distracting influence from the outside will interfere with the men during working hours. Adjoining the main building is the lead and trap department, 30 x 50 feet in size, where drawn lead traps are manufactured.

As shown in Fig. 3, the grinding and buffing wheels are provided with exhaust hoods, the exhaust being carried to a main underneath the floor. The plating room is ventilated from over-head, the air supply being changed every three minutes.

The Foundry.

The brass foundry, Fig. 1, is located in the rear of the main building. It is one-story high and is built of steel and brick throughout. As no columns are used in this building the roof is carried on a steel truss. Metal is melted in four Fisher oil furnaces, shown in Fig. 2, installed by Alfred Fisher, Chicago. Each furnace has a capacity of one crucible. The fuel pipe connecting the battery is shown in the foreground. These furnaces are provided with two covers, the one being designed to protect the operator from the heat while the furnace is in operation, and the other serves as a feeder for the crucible. The top cover is counter-weighted and when the furnace is in operation it is clamped in position. The other cover revolves on a shaft. To facilitate the drawing of the crucibles, an air hoist installed by the Curtis & Co. Mfg. Co., St. Louis, has been provided. This hoist travels on a trolley extending in front of the entire battery. By the use of curved tongs the melter is not com-

FIG. 1—GENERAL VIEW OF THE FOUNDRY OF SOMERVILLE LTD., TORONTO

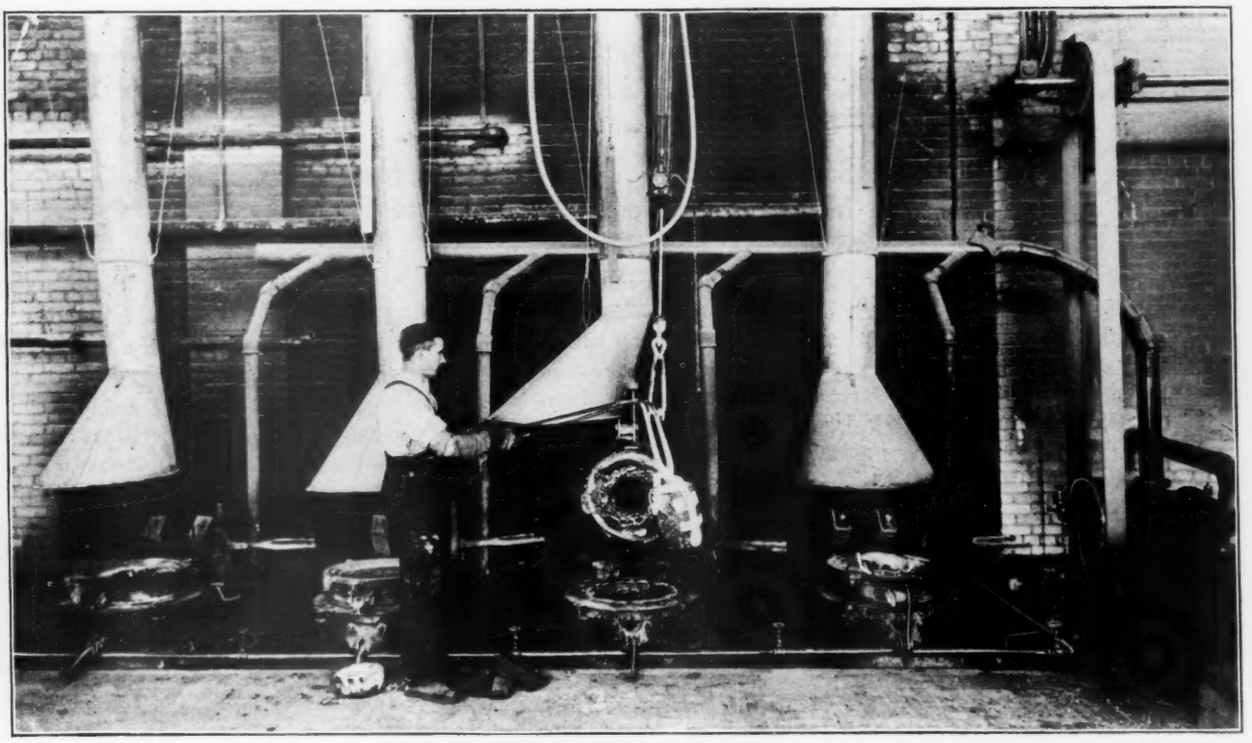


FIG. 2—BATTERY OF FOUR FISHER OIL MELTING FURNACES

pelled to stand over the furnace when drawing the pot.

Core Department.

The core department, which is located at one end of the foundry, is provided with a five-drawer oven installed by the J. D. Smith Foundry Supply Co., Cleveland. The foundry is well ventilated and is provided with a stock room of ample size for brass and copper.

Adjoining the foundry is the power house and boiler room 50 x 75 feet in dimension. It is of fireproof construction, the walls being built of brick and the roof and floors of reinforced concrete. The boiler room is equipped with two 100-horsepower tubular boilers.

The electrical equipment throughout is modern, the conduit system of wiring having been adopted. The entire plant is heated by the hot blast system, which gives a complete change of air every three minutes. Side track facilities are so arranged that

FIG. 3—THE BUFFING AND GRINDING DEPARTMENT

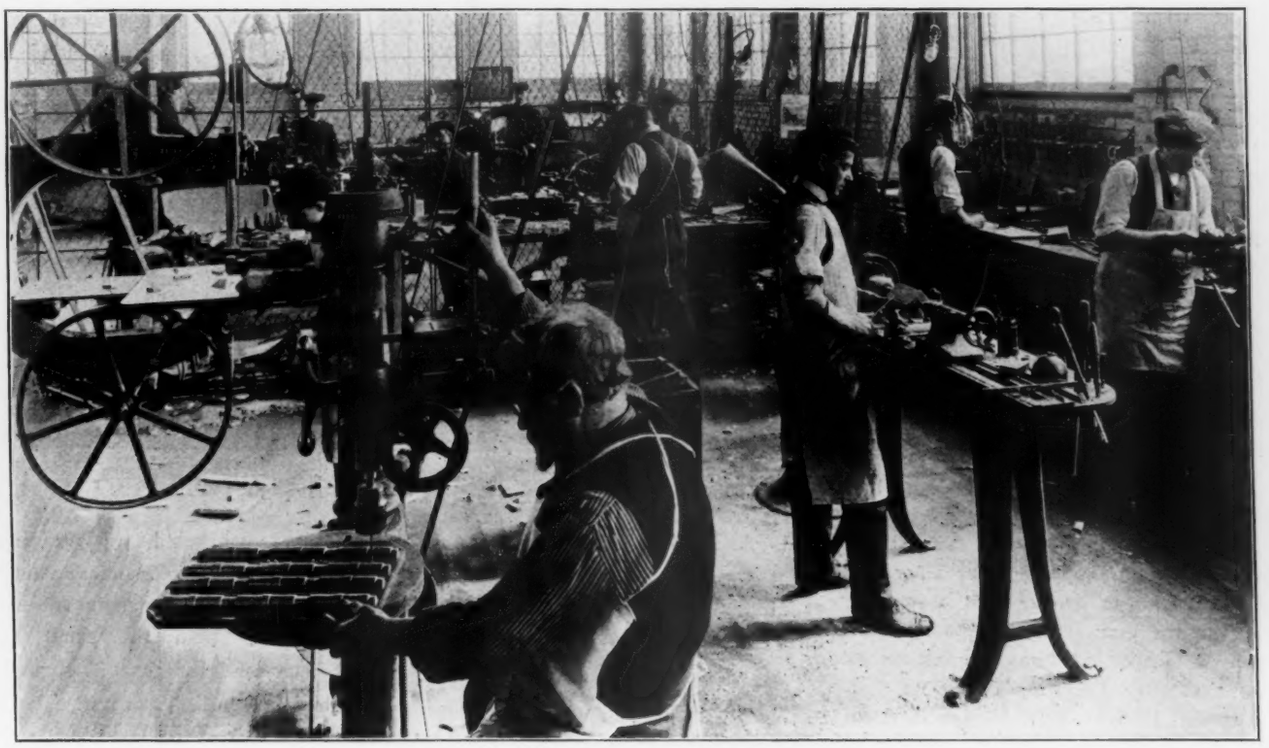


FIG. 4—THE PATTERN SHOP

cars can be brought to the center of the building, thereby minimizing the handling of goods and avoiding delays in shipments. In addition to manufacturing a complete line of plumbers' and steamfitters' supplies, this concern also makes lead pipe, traps, bends, solder and fittings.

THE EFFECT OF MANGANESE IN MANGANESE BRONZE.

BY ALFRED H. COWLES

There seems to be an impression among brass founders that the only object in using manganese in making manganese bronze is to have it act as a carrier in getting the iron into the copper. I have learned by experience that such is not the case, as from many tests made of tensile strength of manganese bronze alloys without iron I find that uniformly higher tests and elastic limits can be secured without the iron than with it.

The manganese bronze of commerce

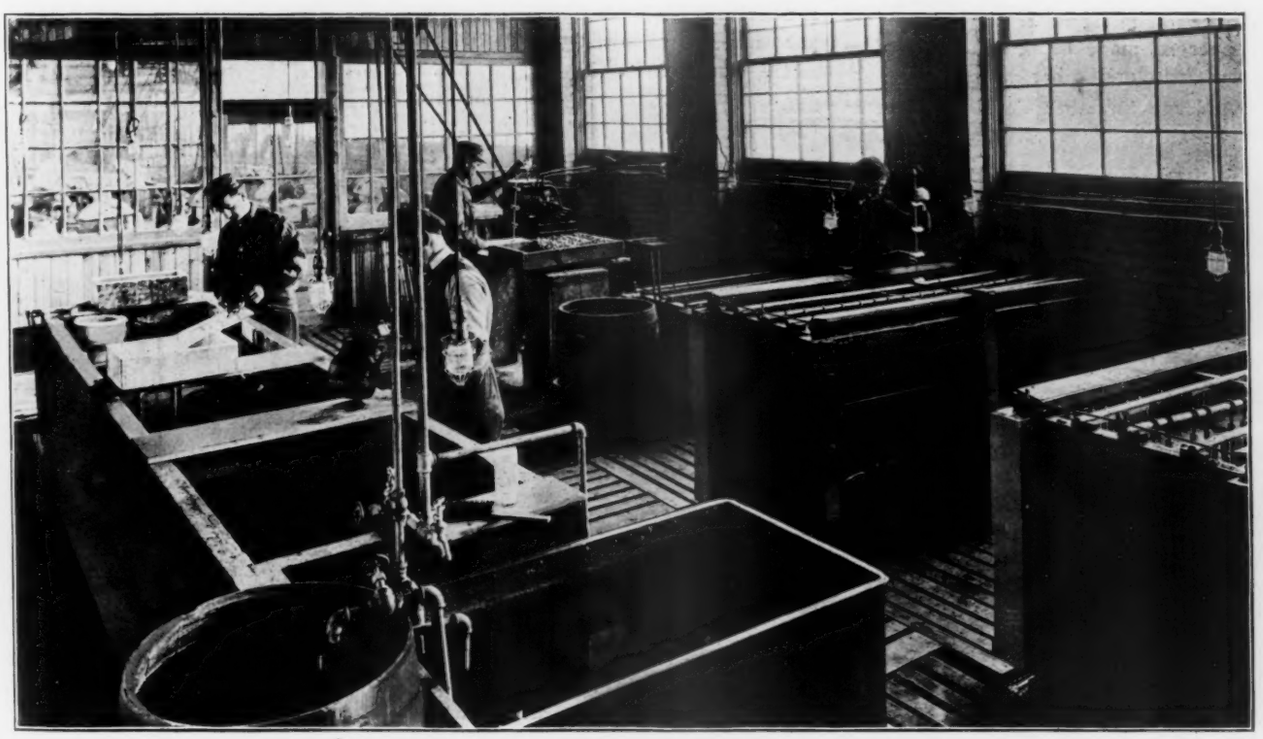


FIG. 5—PLATING DEPARTMENT

FIG. 6—CORE ROOM

FIG. 7—LOCKER ROOM

is an evolution from Thurston's maximum tin, copper, zinc, alloy. In the manganese bronze that was first put on the market in the 80's by Parsons & Dick, iron was a constituent. At that time the only cheap way of securing manganese, as I was told by Alexander Dick, was to melt copper under a layer of molten ferromanganese. The copper would take up a certain per cent of iron and manganese. It was this copper manganese that they were compelled to use in the manufacture of Parsons manganese bronze and Delta metal.

Since that time manganese copper has been made in the electric furnace by the Electric Smelting & Aluminum Co., Lockport, N. Y., using pure manganese oxide as the source of manganese, the manganese copper so made being practically free from iron and other impurities.

A large number of experiments made at the above works since then developed the two facts; first, that the presence of iron was a detriment, and secondly, that the addition of aluminum highly benefited these alloys. As a result of this a patent was granted to the writer for the addition of aluminum to a metal of this nature, and for many years an alloy containing nearly 4 per cent of manganese and free from iron has been made and marketed by the above concern. It has been found that the increased percentage of manganese insures better results than the small fraction of a per cent that is sometimes used in the so-called manganese bronze.

BASSITE—A SUBSTITUTE FOR TIN IN BRASS MIXTURES

BY C. VICKERS

MANY BRASS founders have been interested in a new substitute for tin, called bassite, and have asked themselves, what is bassite? The writer has made an investigation of this metal, the Bassite Mining & Smelting Co., Commercial Tribune building, Cincinnati, having co-operated to the extent of furnishing samples of the alloy together with castings made therefrom, as well as formulas, specifications and printed directions for using this metal, which are generally furnished to customers.

The metal is a white and brittle alloy, which is purposely made this way for the convenience of making weights, as it easily breaks. In appearance it is something like silicon-copper. It has been analyzed and was found to contain copper and zinc and was condemned in consequence as a fraud. The writer was, at first, somewhat prejudiced by this report,

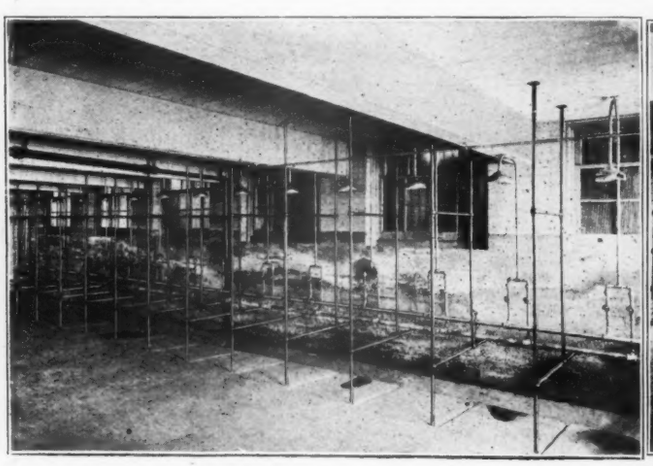


FIG. 8—SHOWER BATHS

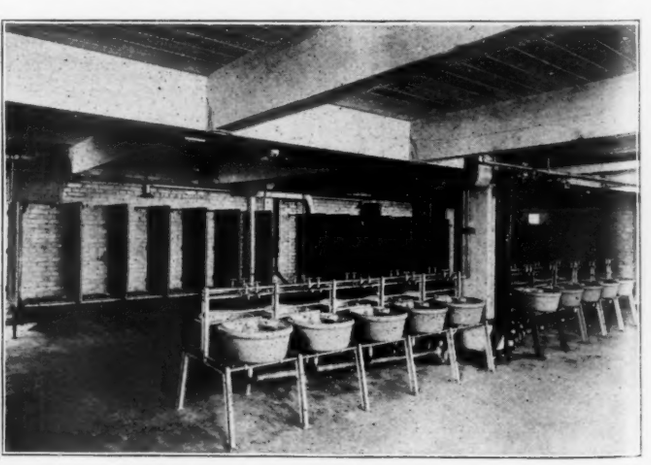


FIG. 9—LAVATORY

but an inspection of the metal convinced him that the analyst had missed the most important part of the alloy—the deoxidizing element contained therein.

Oxidation.

There is one disease that copper and its alloys are universally subject to, a disease that saps the strength of the metal, causing hidden defects in the castings, making them often show up drossy, spongy and dirty. That disease is oxidation—copper rust. Copper dissolves its own rust, or more properly speaking, the oxidized metal is held in suspension with the result above stated. Phosphorus was at one time the universal cure-all for this disease, but like many other cure-alls, time has not sustained that reputation. Phosphorus has its uses and its limitations, and there are many instances where it cannot be used.

The search for a remedy has continued with the result that the brass founder is today familiar with many elements formerly rare and unknown, which are used for deoxidizing purposes. The trouble with these elements is, that they are so powerful they are liable to do more harm than good in unskilled hands. They are homeopathic remedies and should be prescribed in homeopathic doses, and when so prescribed many of them are extremely beneficial in eliminating oxides and producing dense close-grained alloys.

This is all bassite is and all it is claimed to be—a deoxidizing alloy, which by producing a denser metal makes it possible to reduce the tin content sufficiently to make the use of bassite profitable. While it will take the place of tin to an extent, it does not harden like tin. Therefore, for many purposes, both tin and bassite should be used.

Use of Bassite.

In the case of the well-known gun metal, copper, 88 pounds; tin, 10 pounds; zinc, two pounds, the makers of bassite recommend the use of five pounds of their product in place of that amount of tin, making the alloy copper, 88 pounds; tin, five pounds; bassite, five pounds, and zinc, two pounds. Any one can make these alloys, cast test bars, break them and examine the fracture, and I think will find, as I found it, that the one containing the bassite is the better metal of the two.

The following is a list of their formula specifications:

Ordinary steam and water goods, No. 1—Copper, 20 pounds; bassite, 1 pound; zinc, 1 pound; lead, 1 pound.

No. 2—Copper, 20 pounds; bassite, 1 pound; zinc, 2 pounds; lead, 1 pound.

No. 3—Copper, 80 pounds; bassite, 8 pounds; zinc, 4 pounds.

No. 4—Copper, 88 pounds; bassite, 10 pounds; zinc, 2 pounds.

For hard copper castings—Copper, 20 pounds; bassite, 1 pound.

For soft copper castings—Copper, 20 pounds; bassite, 8 ounces.

The directions read: "Put the entire mixture, bassite, zinc and lead, into the copper at the lowest heat that the copper will take the same. Stir well. Bring your metal to a good casting heat (it will have a rich golden color), and pour strong.

"Bassite fluidizes, clarifies and deoxidizes a mixture in about the same degree that phosphorus does, but has no affinity for the latter."

Results of Experiments.

I tried all these alloys, and found them to be as stated. The No. 1 alloy is a good all-round red brass with an excellent color, and if considered too soft, a little tin may be added. The color is an important feature of bassite castings. They possess a most brilliant color, the samples submitted being the prettiest brass castings that I have ever seen. This color is due to the deoxidizing element in bassite, which is used in just the right proportion to produce this effect.

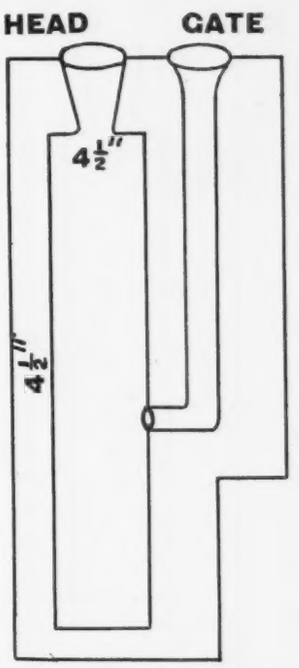
I believe bassite has a wide range of usefulness. There are many brass founders who possibly will not believe in it, having their own formulas, and experts who know how to use them to get the best results. On the other hand, there are many who do not possess these advantages. The small foundry just beginning business, or the manufacturer commencing to make his own brass castings, obliged to trust entirely to the skill and experience of men engaged to manage their foundries, can profitably adopt the bassite formulas instead of trusting to the often dubious knowledge of the use of alloys often possessed by their melters. I have not considered it necessary to tell what the deoxidizing principle employed in bassite is, neither have I told how to make this metal, but I have made my own, using the deoxidizer that this concern uses, and have compared its effect with genuine bassite. I have also replaced the element in bassite with every other deoxidizer and have tested them singly and in all combinations; have compared the fractures in alloys produced with that given by bassite, and have come to the conclusion that this alloy is worthy of a trial by founders who may be troubled with porous or rough, unsightly castings.

PHOSPHOR-BRONZE RINGS.

By Louis Luhrsen

Question:—We make at times heavy phosphor-bronze rings, 3½ feet long and 4½ inches in diameter, which are required to have a high tensile strength and must be fairly hard. In adding tin to secure the required hardness we find that the tensile strength is lowered. Can you give us a good mixture that will give us the required tensile strength and also indicate how the metal should be poured?

Answer:—A mixture that will give a required tensile strength should contain copper, 88; tin, 10; and zinc, 2. If found too soft for the purpose, more tin can be added without impairing the strength. This metal should be melted under a flux, should be well stirred, and should be cast into pigs and remelted before it is poured into the mold. The metal should be poured bright red to obtain the best results. The mold should be made of dry sand and should be gated nearer the bottom to secure the best results. A large riser should be provided to receive the dirt. The accompanying sketch shows how the mold should be gated and also shows the head. The casting can be made in two half cores bolted together and rammed up in a flask on the floor. I mention the molding, because I doubt whether a casting of that length can be made successfully in green sand and meet the necessary requirements.

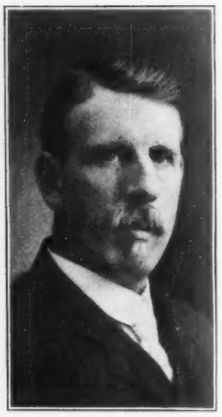


Method of Gating the Mold and the Riser

SPACING AND MOUNTING PATTERNS*

Device for Fitting Patterns Quickly and Accurately on Molding Machines—Adapted to Jobbing Work

BY ALEXANDER M. THOMPSON[1]



THE successful application of molding machines to jobbing work has of late years received considerable attention from machine makers, and some progress has been made in this direction by the introduction of the roll-over type of machine, which, by dispensing with stripping plates and the use of the ordinary wooden patterns enables a jobbing foundryman to use these machines to advantage on flat back work where all of the pattern is in the drag part of the mold.

The writer has been using this type of machine for some time and has found it of considerable advantage for work of this kind as well as split pattern work, when the orders were sufficiently large to warrant mounting the patterns on mold boards.

Orders were not sufficiently large in a great many cases to warrant the expense of accurately locating and mounting split patterns on a mold board, and a large amount of this work had to be made on the jobbing floor by the old method, as the time required by the patternmaker for correct spacing and mounting of the patterns could not be overcome by the reduced cost of molding before the job was out, and the machines would have to be out of commission for a good part of the time.

Seeking a New Method.

It occurred to the writer, that in order to get the full benefit of these machines in the jobbing foundry, it would be necessary to devise some means of accurately and quickly spacing and attaching the patterns on the mold board, without having to take it off the machine and send to the pattern shop to have the patterns mounted by the patternmaker.

What was needed was an arrangement which would enable the machine operator to run a number of different kinds of patterns in one flask with orders for different quantities of each pattern, and he should be able to take off a pattern when completed and substitute another in so short a time that the operation of the machine would not be delayed, and patterns for short orders could be taken off the board and the board used for other jobs.

If this could be accomplished, it would make the machine practically a jobbing work machine, with all the advantages of machine molding.

Device for Spacing and Mounting Patterns.

The device shown in the accompanying illustrations, for which a patent has been applied, will enable an intelligent laborer or machine operator to change and accurately space split patterns on a mold board in so short a space of time that it will be practicable and profitable to make on these machines, castings for which there are orders of two or more.

The device, which is shown in Fig. 1, consists of a frame L, with movable guides X of various sizes and dimensions, and an adjustable end bar R. The guides may be placed at any angle, and made to conform to any shape of pattern as shown in Fig. 2. The adjustable end bar may be moved to suit the pin holes of any flask within the limits of the frame.

Locating the Pattern.

In locating the pattern, the molder or machine operator places one-half of the split pattern A, Fig. 2, on any convenient part of the mold board, and fastens it with brads or screws. The frame L is then set on the board, the pin holes of the frame corresponding with the pin holes on the board, and the guide X is set up against the pattern A, and firmly secured to the frame with thumb screws so that it will not move. The frame is then lifted off the board and turned over. This brings the guide on the other side of the board. The other half of the pattern A is then placed against the guide, and secured to the board.

Pattern B is then located and secured to the board, and the guide X, shown in dotted lines, is moved from pattern A and set up against pattern B, and firmly fastened to the frame L.

The frame is then turned over and the other half of pattern B set up against the guide and fastened to the board. Patterns C, D, E and F are respectively put on the board in the same manner, using whatever form of guide is desirable, thus completing the board with an assortment of patterns

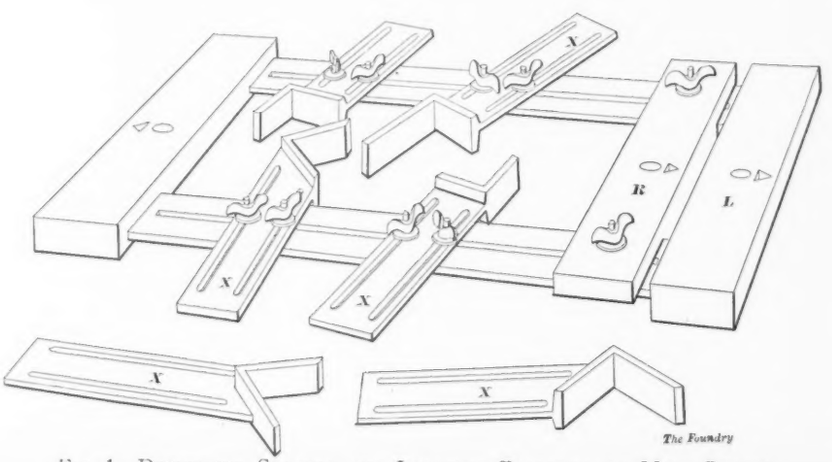


FIG. 1—DEVICE FOR SPACING AND LOCATING PATTERNS ON MOLD BOARDS

*Presented at the May meeting of the Associated Foundry Foremen of Chicago and vicinity.
[1]Foundry Superintendent, 10156 Wallace street, Chicago.

STANDARD SPECIFICATIONS FOR CAST IRON PIPE AND SPECIAL CASTINGS.*

Description of Pipes.

The pipes shall be made with hub and spigot joints, and shall accurately conform to the dimensions given in tables Nos. 1 and 2. They shall be straight and shall be true circles in section, with their inner and outer surfaces concentric, and shall be of the specified dimensions in outside diameter. They shall be at least 12 feet in length, exclusive of socket. For pipes of each size from 4-inch to 24-inch, inclusive, there shall be two standards of outside diameter, and for pipes from 30-inch to 60-inch, inclusive, there shall be four standards of outside diameter, as shown by table No. 2.

All pipes having the same outside diameter shall have the same inside diameter at both ends. The inside diameter of the lighter pipes of each standard outside diameter shall be gradually increased for a distance of about 6 inches from each end of the pipe so as to obtain the required standard thickness and weight for each size and class of pipe.

Pipes whose standard thickness and weight are intermediate between the classes in table No. 2 shall be made of the same outside diameter as the next heavier class. Pipes whose standard thickness and weight are less than shown by table No. 2 shall be made of the same outside diameter as the class A pipes, and pipes whose thickness and weight are more than shown by table No. 2 shall be made of the same outside diameter as the class D pipes.

For pipes 4-inch to 12-inch, inclusive, one class of special castings shall be furnished, made from class D pattern. Those having spigot ends shall have outside diameters of spigot ends midway between the two standards of outside diameter as shown by table No. 2, and shall be tapered back for a distance of 6 inches. For pipes from 14-inch to 24-inch, inclusive, two classes of special castings shall be furnished, class B special castings with classes A and B pipes, and class D special castings with classes C and D pipes, the former to be stamped "AB" and the latter to be stamped "CD." For pipes 30-inch to 60-inch, inclusive, four classes of special castings shall be furnished, one for each class of pipe, and shall be stamped with the letter of the class to which they belong.

Allowable Variation in Diameter of Pipes and Sockets.

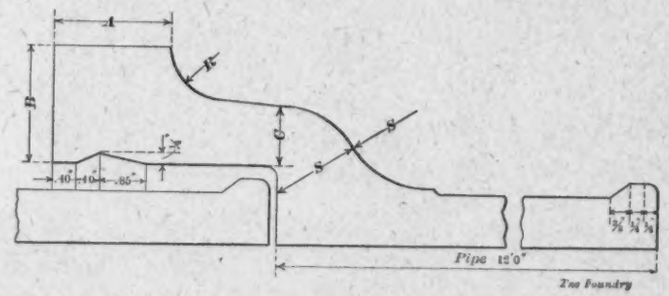
Especial care shall be taken to have the sockets of the required size. The sockets and spigots will be tested by circular gages, and no pipe will be received which is defective in joint room from any cause. The diameters of the sockets and the outside diameters of the bead ends of the pipes shall not vary from the standard dimensions by more than 0.06 of an inch for pipes 16 inches or less in diameter; 0.08 of an inch for 18-inch, 20-inch and 24-inch pipes; 0.10 of an inch for 30-inch, 36-inch and 42-inch pipes; 0.12 of an inch for 48-inch, and 0.15 of an inch for 54-inch and 60-inch pipes.

(Continued on Data Sheet No. 20.)

*Adopted by the American Society for Testing Materials.

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

TABLE No. 1—GENERAL DIMENSIONS OF PIPES



Nominal Diam. Inches.	Classes.	Actual Outside Diam. Inches.	Diameter of Sockets. Pipe. Inches.	Diameter of Sockets. Special Castings. Inches.	Depth of Sockets. Pipe. Inches.	Depth of Sockets. Special Castings. Inches.	A	B	C
4	A—B	4.80	5.60	5.70	3.50	4.00	1.5	1.30	0.65
4	C—D	5.00	5.80	5.70	3.50	4.00	1.5	1.30	0.65
6	A—B	6.90	7.70	7.80	3.50	4.00	1.5	1.40	0.70
6	C—D	7.10	7.90	7.80	3.50	4.00	1.5	1.40	0.70
8		9.05	9.85	10.00	4.00	4.00	1.5	1.50	0.75
8	C—D	9.30	10.10	10.00	4.00	4.00	1.5	1.50	0.75
10	A—B	11.10	11.90	12.10	4.00	4.00	1.5	1.50	0.75
10	C—D	11.40	12.20	12.10	4.00	4.00	1.5	1.60	0.80
12	A—B	13.20	14.00	14.20	4.00	4.00	1.5	1.60	0.80
12	C—D	13.50	14.30	14.20	4.00	4.00	1.5	1.70	0.85
14	A—B	15.30	16.10	16.10	4.00	4.00	1.5	1.70	0.85
14	C—D	15.65	16.45	16.45	4.00	4.00	1.5	1.80	0.90
16	A—B	17.40	18.40	18.40	4.00	4.00	1.75	1.80	0.90
16	C—	17.80	18.80	18.80	4.00	4.00	1.75	1.90	1.00
18	A—B	19.50	20.50	20.50	4.00	4.00	1.75	1.90	0.95
18	C—D	19.92	20.92	20.92	4.00	4.00	1.75	2.10	1.05
20	A—B	21.60	22.60	22.60	4.00	4.00	1.75	2.00	1.00
20	C—D	22.06	23.06	23.06	4.00	4.00	1.75	2.30	1.15
24	A—B	25.80	26.80	26.80	4.00	4.00	2.00	2.10	1.05
24	C—D	26.32	27.32	27.32	4.00	4.00	2.00	2.50	1.25
30	A	31.74	32.74	32.74	4.50	4.50	2.00	2.50	1.15
30	B	32.00	33.00	33.00	4.50	4.50	2.00	2.30	1.15
30	C	32.40	33.40	33.40	4.50	4.50	2.00	2.60	1.32
30	D	32.74	33.74	33.74	4.50	4.50	2.00	3.00	1.50
36	A	37.96	38.96	38.96	4.50	4.50	2.00	2.50	1.25
36	B	38.30	39.30	39.30	4.50	4.50	2.00	2.80	1.40
36	C	38.70	39.70	39.70	4.50	4.50	2.00	3.10	1.60
36	D	39.16	40.16	40.16	4.50	4.50	2.00	3.40	1.80
42	A	44.20	45.20	45.20	5.00	5.00	2.00	2.80	1.40
42	B	44.50	45.50	45.50	5.00	5.00	2.00	3.00	1.50
42	C	45.10	46.10	46.10	5.00	5.00	2.00	3.40	1.75
42	D	45.58	46.58	46.58	5.00	5.00	2.00	3.80	1.95
48	A	50.50	51.50	51.50	5.00	5.00	2.00	3.00	1.50
48	B	50.80	51.80	51.80	5.00	5.00	2.00	3.30	1.65
48	C	51.40	52.40	52.40	5.00	5.00	2.00	3.80	1.95
48	D	51.98	52.98	52.98	5.00	5.00	2.00	4.20	2.20
54	A	56.66	57.66	57.66	5.50	5.50	2.25	3.20	1.60
54	B	57.10	58.10	58.10	5.50	5.50	2.25	3.60	1.80
54	C	57.80	58.80	58.80	5.50	5.50	2.25	4.00	2.15
54	D	58.40	59.40	59.40	5.50	5.50	2.25	4.40	2.45
60	A	62.80	63.80	63.80	5.50	5.50	2.25	3.40	1.70
60	B	63.40	64.40	64.40	5.50	5.50	2.25	3.70	1.90
60	C	64.20	65.20	65.20	5.50	5.50	2.25	4.20	2.25
60	D	64.82	65.82	65.82	5.50	5.50	2.25	4.70	2.60

(Continued on Data Sheet No. 21.)

THE FOUNDRY DATA SHEET, JUNE, 1908.

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication.

from which a varying number of castings will be required.

It is obvious that any point of either pattern A will be exactly the same distance from the pin hole, so that when two halves of a mold are made, they will correctly match, and that also, two castings will be made from each pattern, thus doubling the pattern equipment without additional cost, and also permitting the job to be turned out in a correspondingly shorter time.

When four complete molds have been made, patterns B and C will be finished and will have to be taken off. One-half of pattern G, Fig. 3, may be put in their places by nailing it upon the open space, putting on the frame, setting the guide and turning over the frame as before in order to set the other half of the pattern.

Mounting a Large Pattern.

Fig. 4 shows a larger pattern, which takes up the full width of the flask. As in Fig. 2, the half of the pattern marked A may be placed on any convenient part of the board. No attempt should be made to get it in line with the pin holes. Two guides are used touching the points M, O, P. After the guides have been fastened, the frame is turned over from left to right, and the other half of the pattern, B, is pushed against the guides and secured to the board. When closing the molds made on this board, the cope is turned end for end, as in the case where a flask has a pin in one end and a pin hole in the other.

Patterns may be put on a board, with vibrator frame, one-half on each side of the board, by changing the frame after the guide has been set to the pattern, to the other side of the board and proceeding as already described.

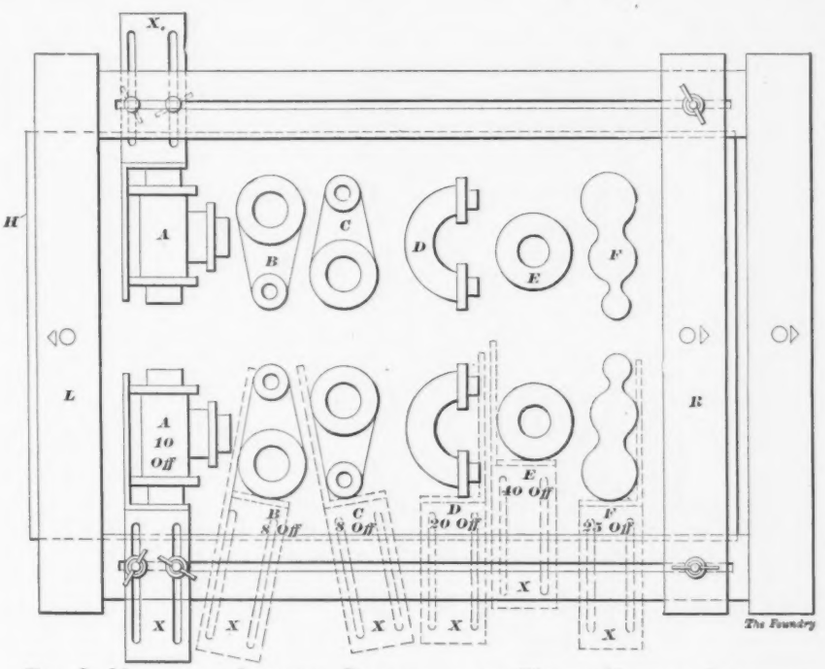


FIG. 2—METHOD OF LOCATING PATTERNS FROM WHICH VARIOUS QUANTITIES OF MOLDS ARE TO BE MADE

Mounting Patterns on Stripping Plate Machines.

For stripping plate machines using iron patterns, the pattern A, Fig. 5, is placed near the center of the cored hole in the stripping plate and bolted to the pattern plate K. The frame L is then laid on the stripping plate and the guide X is pushed up to the pattern and screwed tightly to the frame. The frame is then turned over, bringing the guide to the other side, and pattern B is set against the guide and bolted to the pattern plate K. Patterns C and D are similarly located by turning over the frame, setting the patterns, and bolting to the pattern plate K. The white metal or babbit used to fill in between the patterns and stripping plate is then poured in. With patterns placed this way, a flask may be closed by turning over or end for end, and one machine makes both cope and drag.

In the application of stripping plate machines to jobbing work, a section of stripping plate made of wood or white metal can be produced at small cost, and by its use, the possibilities of these machines are greatly enlarged.

A receiving plate R, Fig. 6, into which the stripping plate sections are placed when in use, takes the place of a regular stripping plate, and wood sections W, with guide pins G, which fit the opening in the plate, should be kept in stock to be ready for emergency cases. When a pattern comes in with an order large enough to make it worth while mounting on the machine, and castings are wanted the same day, the wood section W is placed in the opening of the receiving plate. The pattern C is then placed on the section plate W, and marked around the edge of the pattern on the section plate. The spacing frame is then put on, and the guides set up to the line,

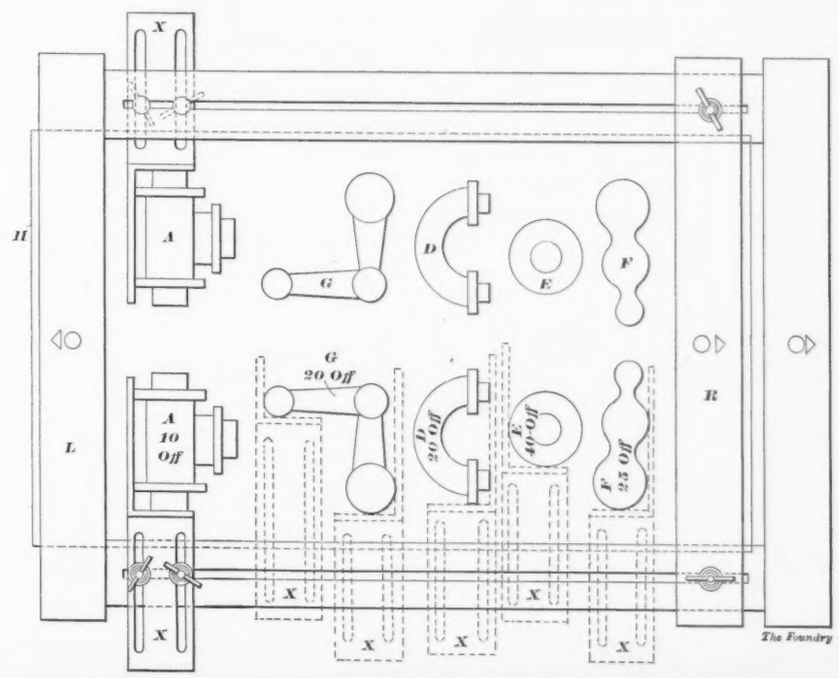


FIG. 3—PATTERNS B AND C, FIG. 3, HAVE BEEN REPLACED BY PATTERN G

turned over, and pattern D set up against the guides, and a line drawn around the pattern D, the same as has already been done with pattern C. The section plate is then taken out of the receiving frame, and the pieces through which the pattern is to pass, sawed out. The section plate is then put back into the receiving plate, and fastened by the screws F, guided by the pins G. The patterns C and D with backing pieces E attached, are put through the stripping plate section and screwed to the pattern plate K, and are now ready for molding. The other half of the plate may be used for other patterns.

For a metal section of stripping plate, take the receiving plate off the machine and place it on the smooth iron plate, F, Fig. 7, face down, locate the backing pieces C and D with the spacing frame, and lay upon them a weight W to prevent them from moving, and pour in white metal about three-quarters full. The backing pieces should receive a coat of black wash to prevent them from being too tight in the stripping plate. When the job has been completed, the patterns and section stripping plate are put back in the pattern vault to be used for another order and by this method a set of patterns may be put on a machine ready for molding in from 15 minutes to one-half hour.

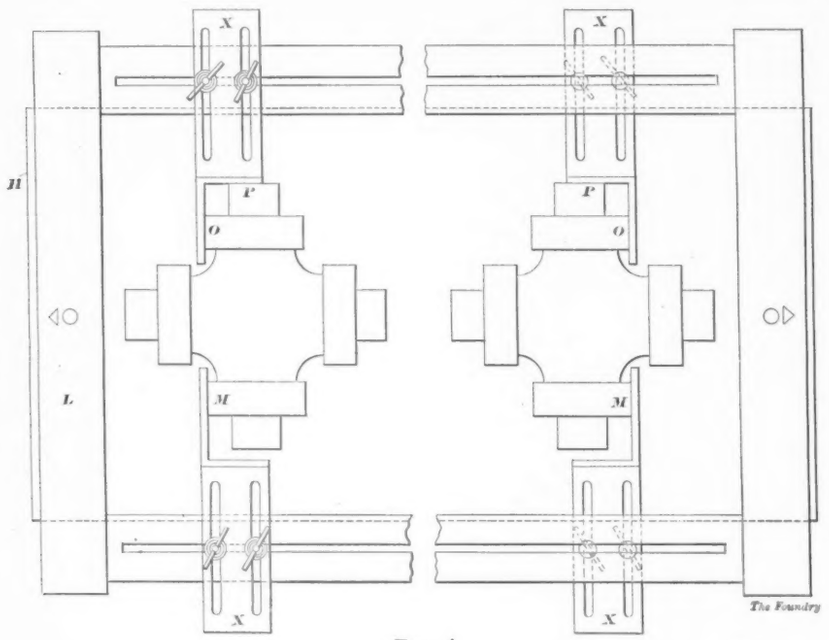


FIG. 4

VIEW OF GUIDES FITTED UP TO "A" HALF OF PATTERN

VIEW AFTER FRAME HAS BEEN TURNED OVER FROM LEFT TO RIGHT, SHOWING "B" HALF OF PATTERN FITTED UP TO GUIDES

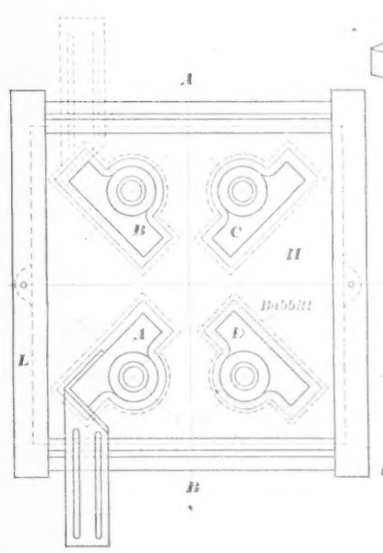


FIG. 5—MOUNTING PATTERNS ON A STRIPPING PLATE

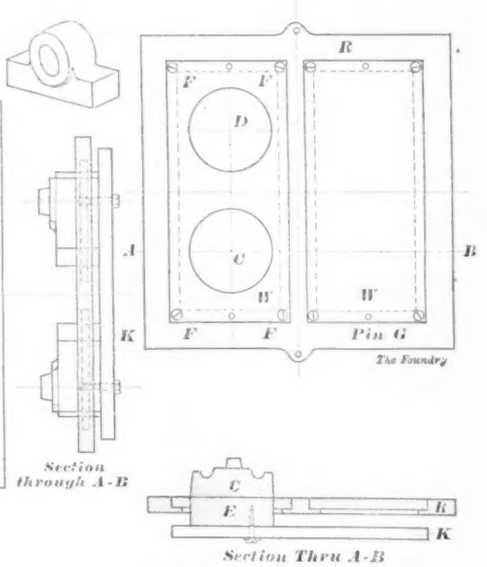


FIG. 6—R SHOWS THE RECEIVING PLATE

Mounting a Large Pedestal Pattern.

Fig. 8 is a large pattern for a pedestal casting. The pattern is laid on the mold board, in whatever way will prevent least interference with the bars in the cope, and the cope should be tried on before fastening the pattern to the board. The frame is then put on, and the four guides pushed up to the corners of the pattern and are screwed tightly to the frame. The other half of the pattern may be put on the same board after the drag half of the mold has been made, or it may be put on a separate board.

In placing a pulley pattern on a board, where only one-half of the pattern has been made, and this half pattern will have to make both cope and drag, the pattern must be absolutely in the center. The two guides, Fig. 9, are screwed to the frame so as to cross imaginary center lines Y and Z. The lines A B and C D are drawn on the board, using the guide for a guide to draw the lines. The frame is then turned over and the lines E F and G H marked from the guides. The frame is now turned over from right to left, to get the lines I J and K L, and turned once more for M N and O P. The lines Y and Z are now drawn where the other lines intersect, and from the center describe a 12-inch circle, to locate the rim of

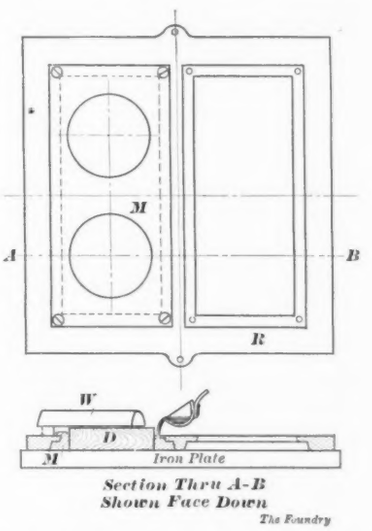


FIG. 7—RECEIVING PLATE IN POSITION ON A SMOOTH IRON PLATE

the pattern. A center line drawn through the arm of the pulley pattern should come on the line Z to locate the arm. To test the accuracy of the rim before molding, the frame may be put on and guides set up against the pattern as shown in Fig. 10. If the frame is turned over from left to right, the guides will show if the pattern has been accurately located.

On pulley machines, where the stripping plates have become worn and allow the pattern to shift, the pattern may be correctly set up by this method.

Pulley or Wheel Patterns.

Figs. 10 and 11 illustrate the placing of a pulley or wheel pattern on

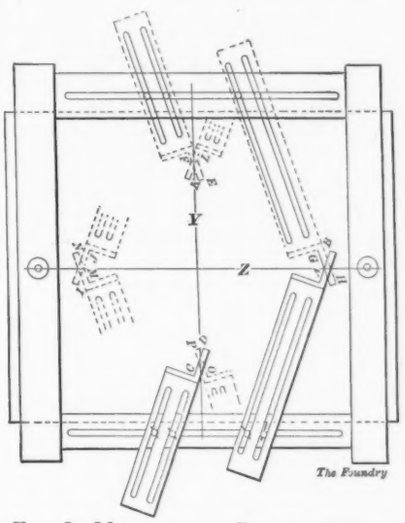


FIG. 9—MOUNTING A PULLEY PATTERN

separate boards where there are two halves for a pattern. The pattern has been placed purposely off the center, and the arms turned away from the center lines in order to demonstrate that no more care is required in spacing patterns of this description than any other. The first operation is to take both halves of the pattern and, placing them together as if it were a full pattern, make a mark or line B anywhere across the face of the rim. Place the cope half of the pattern as near the center of the board as the eye may judge (paying no attention to the arms), and fasten the pattern on the board. Put on the spacing frame and move up the guides anywhere against the pattern, and screw them firmly to the frame. With a pair of dividers, and from the side of the frame at C, get the distance to the line B on the pattern. The frame should then be taken off, turned upside down from left to right and placed on the other board, and the drag half of the pattern placed in between the guides. Set the dividers on the side of the frame at the point C and turn the pattern around until the line B on the pattern comes in contact with the dividers. This will space the arms, so that cope and drag will match.

Fig. 12 shows the drag half of the mold which has been turned over from left to right and lies face up, and it will be seen that a cope made on the cope half of the pattern will match the drag half.

Fig. 13 shows the sequence of operations necessary for placing any number of duplicate patterns on a mold board.

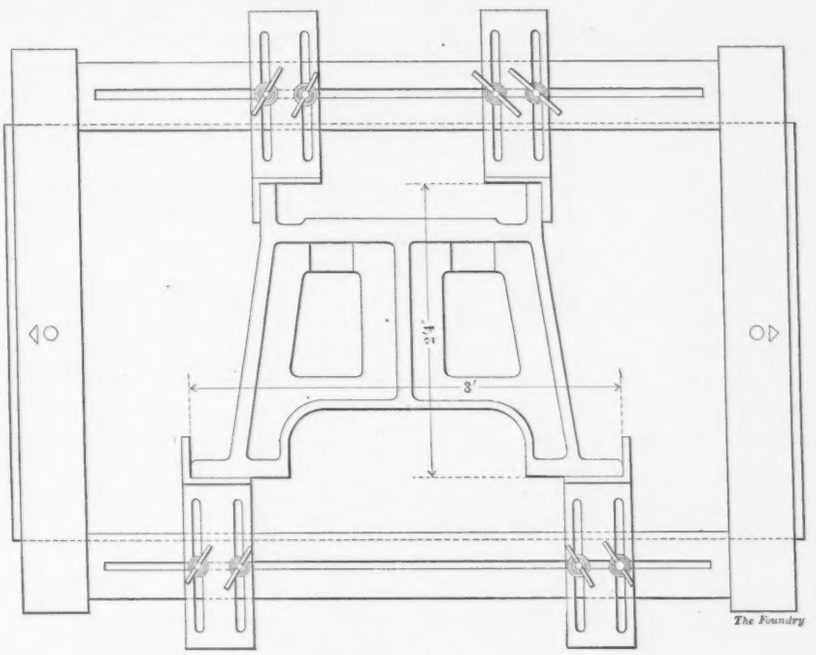


FIG. 8—LOCATING AND MOUNTING A LARGE PEDESTAL PATTERN

AUSTRALIAN NOTES.

BY "KANGAROO"

We had a meeting of foundry foremen in Sydney, N. S. W., lately, and, although we have not as yet attained the dignity of a foremen's association, the peculiar "circs" under which the said meeting was held may yet become historical. Ten of us came together and discussed, among other subjects, "The Best Basis of Selecting Foundry Foremen," "The All-Round Molder" and "The Foundry

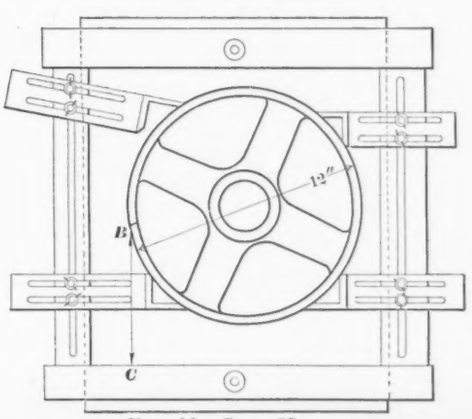


FIG. 10—COPE HALF OF PULLEY PATTERN

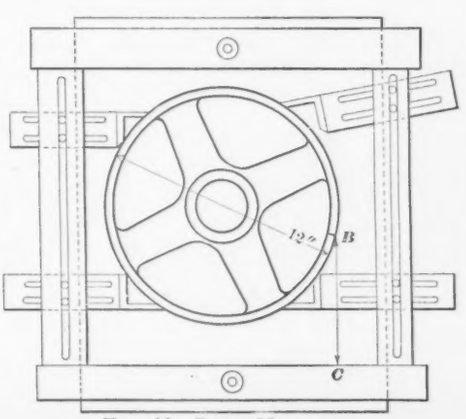


FIG. 11—DRAG HALF OF PULLEY PATTERN

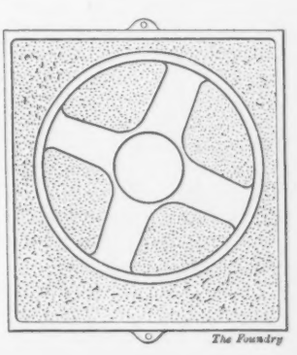


FIG. 12—DRAG HALF OF PULLEY MOLD

Apprentice." It was resolved (quite informally, of course), first, that neither avoirdupois nor linear measurements should enter into the consideration of the first item; second, that a voluble command of expletives should cease to be a recommendation; and third, that as the foundry apprentice is the most active menace to the comfort and permanence of old established foundry workers, his future career should be carefully watched. These were the negative decisions arrived at; the positive or obverse pic

fications—such qualifications as would deter him from being employed where a more general acquaintance with foundry work is necessary. It was indeed gratifying to hear, at this stage, that certain railway establishments, and the British admiralty, made technical instruction a compulsory part of the training of apprentices, and that the time given to attendance at the classes was not deducted from their wages.

* * *

For many, many years, the "mud-

"Beyond the smoke-swept yard the pattern shop is reached. Here, guided by the designs from the draftsmen's department, deft workers are fashioning models of all manner of things in wood. Wheels that can bear no burden, cylinders that will burst at the look of steam, cranks that must crack at a strain—a curious medley of beautifully-made wooden toys keep filling up until the shop begins to look like the playroom of some giant child.

"These toys assume the dignity of usefulness as we follow them to the molding shops, where at first the men seen through the smoke haze are so many grimy specters groping about the black dust floor. A clearer view would seem to show those men returned to their childhood and playing 'mud-pies' with amazing seriousness; but the mud pies turn out to be molds in the sand of the wooden toys from the pattern shop. Into these are poured a molten stream of metal, and if you wait till the mass is cool there will be dug up from the floor

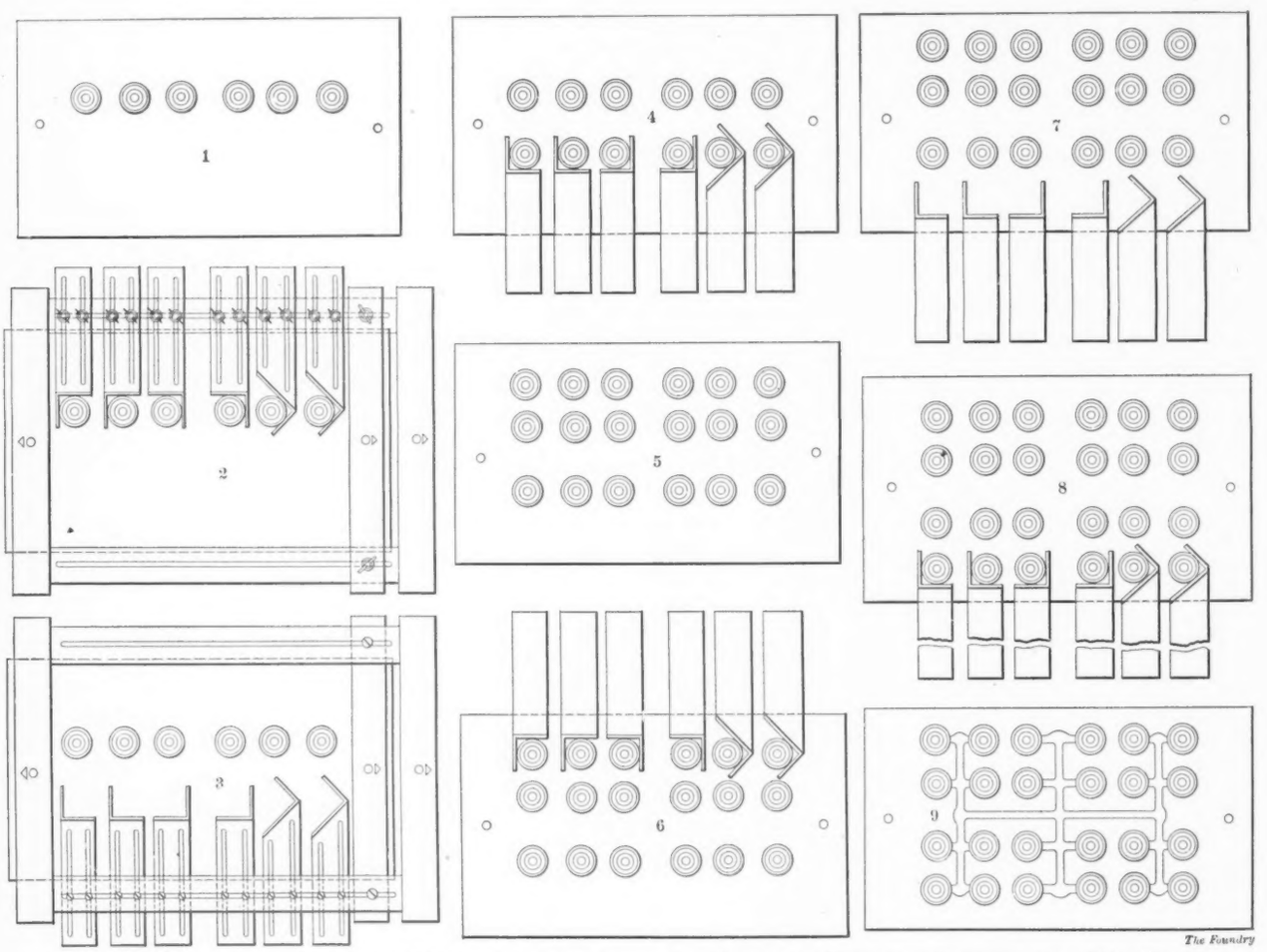


FIG. 13—SEQUENCE OF OPERATIONS NECESSARY FOR PLACING ANY NUMBER OF DUPLICATE PATTERNS ON A MOLD BOARD

1—The first row of patterns is fastened to the board, no attempt being made to space accurately.

2—The frame is put on and the guides are set up to the patterns.

3—The frame is turned over bringing the guides to the opposite side.

4—The first row of patterns is set up to the guides and is secured to the board. These will match with the first row.

5—The third row of patterns is fastened to the board, no attempt being made to space accurately.

6—The frame is put on and the guides are set up to the patterns.

7—The frame is turned over, bringing the guides to the opposite side.

8—The fourth row of patterns is set up to the guides.

9—The patterns mounted ready for molding.

ture I leave to others to construct according to their fancy. Incidentally it was shown that employers have so specialized their business that they want a lad beginning his apprenticeship to acquire one particular branch of foundry work, so that they may reap the benefit of expert labor in the early stages of his course. After the lad has served his time in this way he is supposed to graduate as a molder. He becomes a molder with qua'i-

pie" foundry with its "seething cauldron of liquid flame," and other lurid accessories, has been the happy hunting ground of ubiquitous reporters in search of inspiration; but it has been left to the "junior representative" of an Australian daily to discover in one bold stroke the source of perennial youth and the only logical reason why the average molder does not take his patternmaker seriously. This is his glowing version of the pattern shop:

sturdy iron, steel, gun-metal, or brass replicas of the patterns used. The range of the castings strikes you—from lamp posts to great ocean-going propellers, from many-tonned engine beds to the smallest cast for a motor."

* * *

Poor fellow! 'Twas lucky there was a lamp post for him to hold on to. His ma should put him in his little engine bed and surround him with patterns—no, I mean a curious medley of wooden toys, until he grows up.

METALS IN FOUNDRY PRACTICE

Questions from Practical Foundrymen are answered in this department by the following experts

CAST IRON . . . . . W. J. KEEP
MALLEABLE IRON . . . . . DR. RICHARD MOLDENKE
METALLURGY OF STEEL . . . . . J. B. NAU
STEEL CASTINGS . . . . . W. M. CARR

OTHER EXPERTS ALSO CONTRIBUTE — ADDRESS ALL INQUIRIES TO THE EDITOR

CAST IRON NOTES

BY W. J. KEEP

QUESTION:—Our cupola is lined to 54 inches. We have two rows of tuyeres and the first row is 21 inches above the bottom. The tuyeres are 10 inches high and form a circle around the cupola. Between this and the upper row is a space of 9 inches. Our coke is 16 to 20 inches above the top tuyeres when the blast is put on. Do you consider the following method of charging the best to secure economical results? We use 1,960 pounds of coke on the bed, then we add 3,000 pounds of iron, 140 pounds of coke and follow this with another charge of 3,000 pounds of iron, and then add 280 pounds of coke to 3,000 pounds of iron throughout the remainder of the heat.

Answer:—Stop up your upper tuyeres and you can reduce the depth of your bed 12 inches. The only reason you are using 140 pounds of coke is that your bed is heavier than necessary. Reduce your bed, but keep the coke 18 inches above the tuyeres, before you begin to charge. Then use 260 pounds of coke to 3,000 pounds of iron throughout the heat. Perhaps you can take off the 60 pounds of coke on the next to the last charge and 100 pounds off the last charge, because your cupola is almost hot enough to melt the last charge without coke. Go slow in making these changes, reducing the amount of coke slightly each day.

IRON FOR PACKING RINGS.

Question:—I would like to have a mixture that will be suitable for packing rings. These must have a close grain and should have plenty of spring. The mixture must be melted in a Colliau cupola, 27 inches inside the lining. I would also like to know the best method of charging the same. The rings range in size from 12 to 28 inches in diameter and from ½ to 1⅛ inches in thickness. They are to be cast in drums and cut off to the required size.

Answer:—Keep the silicon as low as possible to permit of machining. The higher the combined carbon the greater the spring and the closer the grain. I would suggest that the upper tuyeres be stopped and when you begin to charge have the coke 15 inches above the lower tuyeres. Charge 600 pounds of iron and 60 pounds of coke after this. Light your fire two hours before the blast is put on to get the cupola hot.

CROOKED CUTTING BARS.

Question:—We are making cutting bars which frequently warp after they have been shaken out of the sand. Do the proportions of the pattern have anything to do with the warping?

Answer:—The shape of the pattern largely controls the subsequent warping of the casting. You can shape the bars so that they will come straight. Why not peen the face on which the knife is riveted? A good molder will sometimes ram a mold after the bars are poured so as to straighten them. Also try to bend the pattern the opposite way so that the warping will bring them straight.

MORE THAN ONE KIND OF IRON FROM ONE CUPOLA.

Question:—Is it possible to pour together or to melt alternately in a cupola, two hard, cheap mixtures, and by careful calculation to produce a soft, strong mixture and still another that will produce a considerable chilling effect?

Answer:—By sufficiently increasing the charge of coke between the different kinds of iron you can drain the cupola of one kind before the next mixture comes down. In this way you can melt as many mixtures as you choose. It is advisable to pour an iron that might be a mixture of two kinds into work which will not be affected by the procedure. Would suggest that you pour the chilling iron first, then the cheap mixture and your good, strong iron last. The reason for this is that the first iron has a tendency to chill and the last iron is always softest, on account of the high temperature of the walls of the cupola.

HEAVY AND LIGHT CASTINGS FROM ONE HEAT.

Question:—We are endeavoring to cast light castings of thin section with our ordinary run of work. We melt a total of 7,500 pounds of iron at a heat, made up of 2,000 pounds of No. 2 soft iron and the balance is machinery scrap. Is there any flux or alloy that we can add in the ladle that will enable us to run these thin sections with our regular heat?

Answer:—The trouble is that your silicon is not high enough for your thin castings. If you can purchase a few tons of silvery iron and add enough to the last charge to soften the iron you can succeed in casting these thin sections. Ferro-silicon, 50 per cent, added in the ladle will also soften your castings. The use of aluminum in the ladle will also soften your iron.

UNSOUND CASTINGS.

Question:—Our castings are full of blow holes under the skin, which do not show until after the castings have been machined. We are using a high grade Connellsville coke and the iron is poured very hot. We use limestone as a flux and the molds are well vented.

Answer:—Would suggest that you have your castings analyzed so as to ascertain the amount of sulphur they contain. If it is above 0.08 per cent the trouble is due to this element. Con-

nellsville coke is liable to run very high in sulphur, notwithstanding the low sulphur content which its name implies. Suppose you try a car of Solvay coke with sulphur below 0.80 per cent. Try some limestone from the Sibley quarry, which can be purchased from Little & Co., Detroit. This limestone is absolutely free from sulphur. Also use a little powdered ferro-manganese in the ladle, and also add a little pure aluminum in the ladle. You can secure the aluminum in 3/8-inch rods. The aluminum will stop the blow holes until you can remove the causes of your unsound castings.

LEAKY CYLINDERS.

Question:—Our cylinders show a tendency to leak at several points where the metal is heaviest. We have poured our iron cold and have used considerable scrap. We have also attempted to mix steel in the ladle, but without success. If possible kindly tell us how to overcome the difficulty.

Answer:—If you find a tendency to wards shrinkage and sponginess at the leaky points, reduce your silicon as low as possible, but not so low that it will interfere with machining. You do not state the brands of iron that you are using. The use of irons made from Lake Superior ores will make the iron set quicker in the molds before it has time to become porous. The use of scrap generally overcomes this difficulty. Wherever possible bed an iron chill in the mold so as to set the iron quickly at the point that is liable to leak. If possible change the pattern so as to remove the heavier parts of the casting.

USE OF CAST IRON BORINGS.

Question:—Have you had any experience with the melting of cast iron borings at the end of the heat, running off one or two tons in the pig bed? We have tried to use our turnings during the past few months with varying results. The first time we put them into the cupola loose, the results were disastrous. The second time we put them in, banding the boxes, we recovered about 60 to 70 per cent and the metal came extremely hard.

Answer:—You can cover your sand bottom with borings to a depth of 2 to 3 inches and the molten iron will melt them. The iron will be very hot, but will be soft and can be used for work that you are not very particular about. If you made the layer only 1 inch thick, you would never notice any difference. There would be no loss. The best method of using these borings is in pine boxes made of 1-inch lumber that will hold about 100 pounds. The cover should be nailed on securely. Charge one box with each ton charge or two boxes with a 3,000-pound charge. The losses will not average over 10 per cent and your castings will be improved both as to grain and as to strength. The concern making the inquiry has replied that the method has proved a success and that heretofore too many boxes of borings had been used.

STEEL IN BRAKE SHOE SCRAP.

By N. W. Shed

Question:—Will you kindly inform us what becomes of the steel in brake-shoe scrap when it is remelted? Is there a wastage in having this steel in the iron and does it burn up in the cupola? Furthermore, are the set screws and pieces of steel in scrap detrimental to iron used for machinery castings?

Answer:—The steel in brake shoe scrap melts into the cast iron and becomes part of it. Its effect upon the iron is to reduce the amount of graphite and also lowers the silicon. This increases the strength of the iron and makes it harder. The flakes of graphite are reduced in number and the metal is denser and does not cut as readily under the tool.

The lower silicon tends to make the combined carbon greater. This is the main cause of the increased hardness. There is no wastage on account of the steel being present. The steel will not burn if properly melted.

The set screws and pieces of steel are not detrimental for iron used in machinery castings, provided that the iron produced is not allowed to get too hard. The steel loses its identity as steel and becomes a modified cast iron.

As an illustration, suppose the cast iron in the brake shoes contains 2 per cent silicon. It often contains much less than this. If castings were made of straight brake shoe iron without steel the mixture might be:

	Silicon per cent
30 per cent brake shoes at 2 per cent	0.60
70 per cent pig iron at 2.50 per cent	1.75
Total silicon	2.35

Suppose the brake shoes contain 20 per cent steel; as the steel is practically free from silicon the scrap will contain but 80 per cent of 2 per cent silicon, which is 1.60 per cent silicon.

Now the mixture is:

	Silicon per cent
30 per cent brake shoes at 1.60	0.48
70 per cent pig iron at 2.50	1.75
Total silicon	2.23

This makes the silicon 0.12 per cent low. To bring up the silicon it will be necessary to reduce the scrap and add more pig, or else add pig containing more silicon.

If we use 20 per cent brake shoes and 80 per cent pig we will have:

	Silicon per cent
20 per cent scrap at 1.60	0.32
80 per cent pig iron at 2.50	2.00
Total silicon	2.32

If we use a higher silicon pig we have:

	Silicon per cent
30 per cent brake shoes at 1.60	0.48
70 per cent pig iron at 2.70	1.89
Total silicon	2.37

As a general rule it would be well to reduce the brake shoe scrap a little and add 10 per cent of soft pig running 3 per cent in silicon and 1½ per cent phosphorus.

Brake shoes are generally considered poor scrap running high in sulphur and to use them in making soft iron it would be well to make a heat of about this composition:

Brake shoe scrap, 20 per cent; soft scrap, 30 per cent; pig iron, 2.50 per cent silicon, 40 per cent; high phosphorus pig, 3.00 silicon, 10 per cent.

Manganese is useful if steel is to be melted. Ten to 15 pounds of ferro-manganese to the ton of iron can be charged. The manganese in the castings should be 0.60 to 0.80 per cent.

TINNED MALLEABLE CASTINGS.

By Richard Moldenke

Question:—We manufacture malleable iron saddlery hardware and have had some difficulty with the castings after they have been tinned. They are extremely brittle and break when they are bent into shape after removal from the tinning bath. Before they are tinned they can be bent without breaking.

Answer:—Samples of the malleable castings after anneal are certainly very fine. The tinned samples, however, when broken are finely crystalline and white, similar to slightly burned and quenched, high carbon steel, in the thinner portions, and partly white in the thicker. The difficulty lies entirely in the method of tinning pursued. It is necessary to keep the temperature of the tin bath as low as possible consistent with good work. Futhermore, the castings after tinning must not be quenched too rapidly. The reason for this will be seen in studying the malleable casting under heat after

the anneal. It is well known that a malleable casting when heated to redness and plunged into water will revert to its former state to some extent. The graphitic or temper carbon is re-dissolved, and a state similar to quenched steel is manifest. For that reason, when straightening castings, especially the heavy ones, it is absolutely necessary that this be done cold. Very thin castings, from which most of the carbon has disappeared may be straightened hot, as they are more like wrought iron, but heavier work must be bent, hammered, or otherwise treated cold.

I have seen carload lots returned to foundries where the mistake of heating one end of a casting for straightening purposes was made. The heated end was white and the cold end remained black in fracture. In the castings in question, they were either tinned too hot, or quenched too soon, or both.

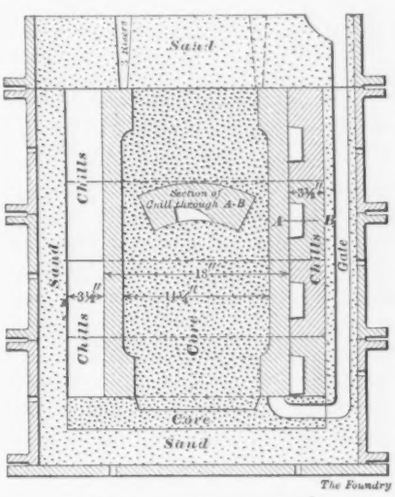
CHILLED ROLLS.

By Alexander E. Outerbridge

Question:—The accompanying sketch shows a roll that is cast entirely in chills. We have tried all car wheel scrap, half No. 6 charcoal iron and half car wheels, also three-quarter No. 6 charcoal with one-quarter soft pig. Some of the rolls have a fairly good chill, while others show no chill at all, and several of them cracked at the ends. We have recently installed a new cupola lined to 40 inches inside, driven by a No. 4 Baker blower. We have speeded the blower to 250 revolutions per minute and have been unable to get more than three ounces of blast pressure in the cupola at any time. We believe our chief difficulty is due to insufficient blast, which prevents us from getting hot iron. The rolls must withstand severe shocks, and should have a chill of at least ½ to ¾ of an inch. We would like to know what changes could be made, if any, both in molding, melting and pouring of the iron. We would also like to know whether we are using the right grade of iron for making these molds?

Answer:—The sketch shown in the accompanying illustration is an excellent one and shows the details of the chill molds very clearly. It also shows good design and construction which probably could not be improved, so that the question of the mold itself may be eliminated from this discussion.

With regard to the statement that "some of the rolls have a fairly good chill, while others show no chill at all and several of them cracked at the ends," the writer would say that as the chills are 3½ inches thick and the metal of the roll is only 1¼ inches thick, any one of the mixtures of iron given, would, if properly melted, give a fluid metal, having far too high chilling properties and should make the roll castings entirely white iron and, therefore useless. If the roll would not crack in cooling, it would certainly break in service, owing to the extreme brittleness of white iron. Chilled car wheels are made of iron containing less than one per cent of silicon, about 0.7 per cent, and when remelted alone the metal is still lower in silicon, and if poured into a green sand mold 1¼ inches thick, having no chills the casting will be mottled and often quite white.



Mold for Chilled Roll

The "No. 6 charcoal iron" is presumably still harder than the car wheel scrap and the addition of 50 per cent, or of any other proportion, of such scrap will have a tendency to aggravate the trouble.

It is quite evident that there is something wrong about the cupola, the blower or tuyeres, probably the latter. It happens that the concern with which the writer has been connected for more than 20 years, as metallurgist, has two cupolas 42 inches inside diameter, and one of these is driven independently by a No. 4½ Baker blower, so that these conditions are almost identical with those stated in the inquiry.

Exceedingly hot and fluid metal is melted in this cupola, and partly for this reason it is used almost exclusively for melting soft iron for pouring the lightest castings made, many of them weighing less than a pound. We have also made chilled castings very successfully from special mixtures in this cupola, and it may be of value therefore, to give the usual methods of charging. At the present time anthracite coal is the fuel used, but coke has been substituted therefor whenever the relative cost of coke and anthracite made it more economical to melt with coke. Starting with a bed of 1,400 pounds of coal, a charge of 5,000 pounds of iron is put thereon, then 400 pounds of coal followed by 5,000 pounds of iron, which is continued until the final charge of coal, which is 100 pounds less than the other charges. Assuming that we have a melt of 30,000 pounds of iron, we consume 3,300 pounds of coal, counting the bed, which gives us a ratio of iron melted to fuel consumed of 9.09. The iron is, as already stated, very hot and fluid.

The speed of the blower is fixed at 131 revolutions per minute and each revolution displaces 16½ cubic feet of air. The pressure of air in the blast pipe was found several years ago to be about 16 ounces. This, however, increases on long heats, due to back pressure in the cupola, caused by some accumulation of pasty slag. The pressure in the cupola itself is, of course, very much less. The proper number of revolutions per minute of a No. 4 Baker blower for a cupola lined to 40 inches inside diameter (these figures being given in the inquiry) is stated, by the makers, to be 165, and if melting has been attempted when the blower has been speeded up to 250 revolutions per minute, it is not surprising that failure has resulted therefrom.

As no information is given regarding the number and size of tuyeres we can offer no opinion regarding this important feature, but the inquiry states, "we believe that our chief difficulty is due to insufficient blast which prevents us from getting hot iron." Certainly the insufficiency of blast cannot be charged to the blower and the suggestion is therefore made that the size and shape of the tuyeres be investigated. Regarding the final inquiry as to "what changes could be made in melting and pouring the iron, also as to whether the right grade of iron is being used." the following answers are given:

First, the mold appears to be perfect in design and construction, and, therefore, no changes can be suggested.

Second, the melting appears very defective for reasons already stated and

suggestions for remedying the same have been made.

Third, the grade of iron has probably too high chilling qualities when properly melted.

Presumably the rolls, which must withstand severe shocks, should be made of gray iron in the main body to resist shocks, with a hard white iron surface to resist wear, about a quarter of an inch deep as a maximum. To obtain this result considerable soft iron should be added to the car wheel scrap, probably 50 per cent, in the place of adding No. 6 charcoal iron, and small chill test pieces similar to those cast in car wheel foundries should be poured, cooled quickly and broken for inspection before the rolls are poured. If the chill tests show that the metal is still too high chilling, as is quite possible, it can be softened down to any desired degree by adding high grade ferro-silicon in powdered form to the metal in the ladle before pouring the molds. Inasmuch as these chilled rolls must withstand severe shocks they should be annealed the same as chilled cast iron car wheels. No chilled wheel is ever put into service without having been annealed by a slow cooling process, extending over a period of at least three days.

SANDWICHED HARD SPOTS

BY EDWARD KIRK

THERE has been considerable inquiry recently regarding hard spots and hard streaks in iron, and as the foundrymen appear to be having nearly the same difficulties as founders years ago, a little experience with sandwiched irons many years ago may be of interest

The writer first had an experience with this iron at Albany, N. Y., in 1876. At that time the stove foundries in that city and vicinity were melting principally Lehigh valley irons, which for a long time had been their leading brands giving good satisfaction in their stove plate. But without any change whatever in the fracture indication or general appearance of the iron, it began to run hard in spots, although still a soft, strong iron. Upon investigation, I found that the hard spots were not those of the ordinary hard iron, extending through the casting, but that the hard iron was inside of the soft iron with a well-defined line between the hard and soft iron. In very light plate, this hard iron was found in a thin plate between two thicker plates of soft iron on the outside and I gave it the name of sandwiched iron, the hard iron being between the plates of soft iron and not combined in any way with them.

In lugs and thicker parts of the casting, it was sometimes found in small globules or oblong pieces. This was the form it assumed in door lugs and hinges where it was found in drilling, but it was never found in all the lugs upon the same casting. This indicated that it was not distributed throughout the iron, but appeared to float in the molten soft iron in small globules which were carried into the mold with the iron, and left where they chanced to be when the iron set. When the iron flowed into light plate, these globules were carried with it and spread out into a thin plate, and when it run into lugs, it retained its globular shape, to a greater extent, but never united with the soft iron by extending fibers into it, and the globules frequently dropped out of the soft iron when it was broken.

These spots appeared when only pig and remelt scrap was melted and none of the scrap was rusted. A peculiar feature was that the hard spots were more numerous when all No. 1 pig was melted, and entirely disappeared when all No. 2 pig of the same brand was used. These spots were afterwards traced by the furnacemen to a New Jersey ore they were using in their mixture to make a cheaper iron, and when this ore was left out of their ore mixture, the spots entirely disappeared from the iron. Chemists were not then employed by blast furnacemen and I am not aware that the element or metalloid in this ore that caused the hard spots has ever been determined but they were probably due to a small percentage of titanium. Since that time, the writer has frequently met with these spots in castings, but has never been able to trace them to the pig melted. Although in some cases the fresh fracture was badly spotted with patches of very small light colored crystals, indicating a harder iron, these spots never appeared in the casting as a separate iron, and either disappeared when the iron was melted, or appeared in the casting, as a harder iron throughout the casting, or as hard spots extending through the casting and connected by fibers to the softer iron. In other cases where sandwiched spots were found they were traced to scrap melted with the pig and the writer has produced spots in stove plate exactly like those found at Albany, by melting badly burned iron with soft stove plate pig, and has also produced them by melting badly rusted shot iron with this pig. Attempts to produce them with wrought iron and steel scrap failed. These metals hardened the iron throughout or appeared as hard spots combined with the soft iron.

Sandwiched spots are never found when a close or hard iron is melted with burned iron or rusted shot, but they appear when these irons are melted with a high carbon soft iron and are probably due to the failure of the oxidized iron of the burned iron and rusted scrap, to mix with this iron. Sandwiched hard spots differ from other hard spots in the hard iron, being separate and distinct from the soft iron in which they are enclosed, while in other hard spots the hard and soft iron blend together and extend fibers into each other, and may be due to uneven pig, wrought iron and steel scrap, or other scrap that does not mix well with the pig, or other iron with which they are melted. They may also be due to wet sand, uneven and hard ramming, cold ladles, etc.

RECOVERING GRINDING DUST.

By C. Vickers

Question:—What is the best method of recovering grinding dust from brass castings? Is it possible to recover copper and zinc systematically and can it be done economically?

Answer:—If you are careful to keep the grindings free from sand, they may be melted down as easily as any other brass. In my practice I always tumble the castings clean before grinding and I have a box under my emery wheel which catches the dust, and when this box is full I simply empty it into some melted brass, allow the dust to become warm and then push it down into the melted metal. Thus I have no accumulation of emery dust, and consequently no loss from this source. If, however, you grind your castings before tumbling, the emery dust will be mixed with sand, and you cannot recover the brass economically in a crucible, so it will be best to sell your accumulation.

MILWAUKEE FOREMEN.

The Milwaukee Foundry Foremen's Association has been reorganized and the following officers have been elected: Henry Biegel, president; Philip Nelson, vice president; Julius Germanson, secretary, and J. M. Marshall, treasurer. This local now has 37 members in good standing and meetings are held every second Tuesday in the month.

NOVEL AIR AND ANNEALING FURNACES

For Reducing the Time of Making Heats and the Annealing of Castings in Three Days

ONE OF the heavy items of cost involved in the manufacture of malleable castings is the annealing expense, and many devices have been tried by manufacturers in the past to reduce this charge, but practically all have proven unsuccessful. By the methods pursued by the Allegheny Valley Malleable Iron Co., in its new plant, New Kensington, Pa., castings have been successfully annealed in 3½ days in a green oven and later this time was reduced to three days. When subjected to the same tests given castings that remained longer in the anneal, they showed physical properties that compared favorably with the latter. Furthermore, the time required for making malleable heats has been considerably reduced by this concern, whose practice in these two departments shows marked advancement in this line of work.

Location of the Plant.

The plant is favorably located in the Pittsburg district where an ample supply of fuel and pig iron is insured at a minimum cost. The works are well arranged for economical production. The foundry is built at right angles to the annealing department, the pattern shop, core room, pattern storage and power plant paralleling the foundry. The plant has been laid out so that another foundry can be added at right angles to the other end of the annealing house.

The foundry is 440 feet long and 80 feet wide, one of the side bays being shown in Fig. 4. The iron is melted in two 15-ton reverberatory furnaces, each being located 110 feet from either end of the shop. This reduces the distance that the iron has to be carried from any of the floors to 110 feet and reduces the average distance to only 55 feet.

The Melting Furnaces.

The furnaces are of special design and have been built with a view to reducing the time required to make ordinary heats. Metal has been tapped in 2½ hours after charging, on a fuel consumption of 600 to 800 pounds of Pittsburg gas coal, per ton of iron. The furnaces have an over-all length of 42 feet from the front of the firing boxes to the rear of the stacks. The furnaces proper are 35 feet long and have a width over-all of 8 feet. Between the bridge walls the furnaces have a length of 20 feet and the necks, which are larger than usual, are 10 feet in length. Each furnace is provided with a 60-foot stack, 60 inches in diameter inside the shell. The firing side of one of the furnaces is shown in Fig. 11, and the opposite side in Fig. 9. Exhaust hoods have been placed over the firing doors to carry off the heat and gases while firing. The coal is conveyed to the furnaces in small cars which operate on a narrow gage track extending into the yard. Hand operated cranes over each furnace are used for removing the furnace bungs. Each furnace is provided with two spouts and can be tapped from either side. The blast is introduced into each directly over the first bridge wall, as well as underneath the grate. Two Buffalo Forge blowers mounted on elevated, enclosed platforms near the furnaces, to reduce the length of the blast pipe, furnish the air at a pressure of 3½ to 4 ounces. These were installed by the Buffalo Forge Co., Buffalo, and are operated by 20-horsepower motors.

Skimming and Testing Doors.

A new type of pivoted skimming and testing doors is shown in Fig. 10. These are supported in the end of a frame and when closed insure a perfect fit over the openings. The chief ob-

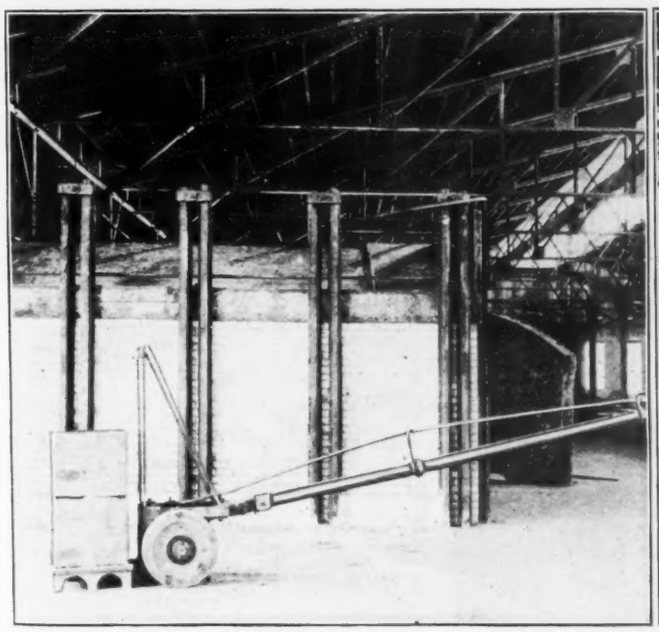


FIG. 1—ANNEALING FURNACE CHARGING TRUCK

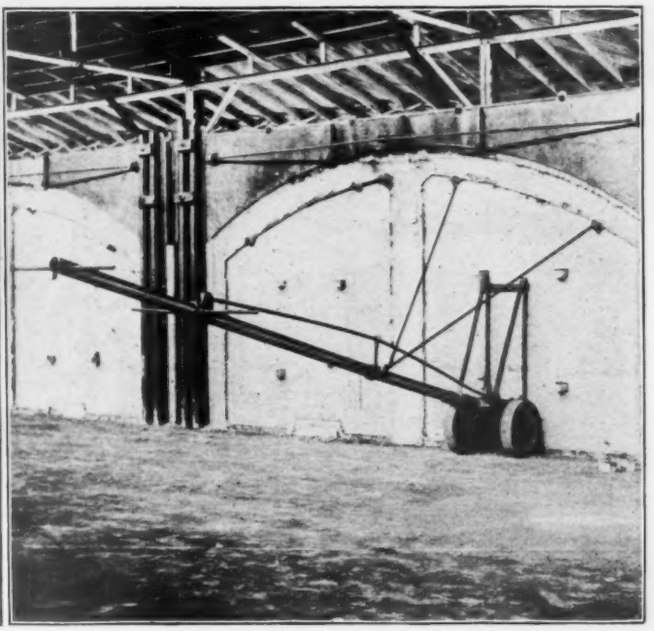


FIG. 2—CHARGING TRUCK IN POSITION TO REMOVE FURNACE DOOR

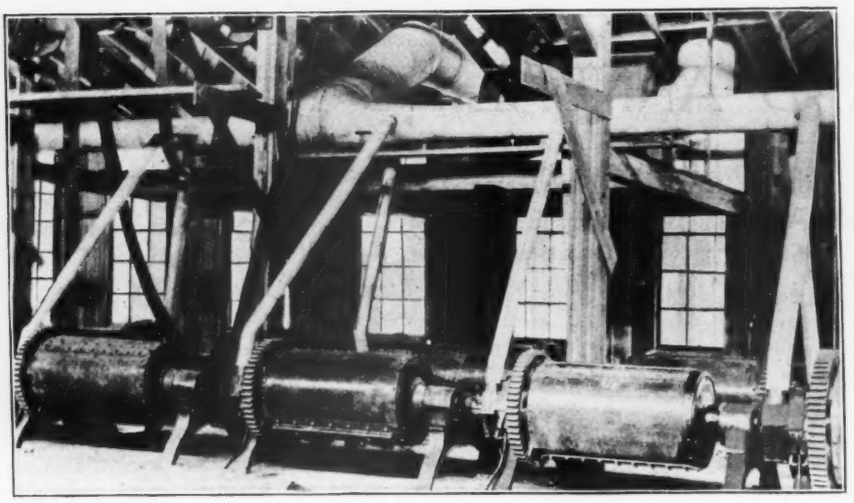


FIG. 3—EXHAUST EQUIPMENT FOR TUMBLING MILLS

jection to the hinged doors has been overcome by this construction, and in addition they can be used as a protection to the skimmer while taking off the slag, as they can be swung over the opening, thereby deflecting the heat from the furnace, but in no way interfering with the skimming operation. The doors are lined with fire brick of standard size which are clamped in a frame and are thereby held in position until they have been melted down. The high stacks of these furnaces as well as the long necks, which insure an unusually high draft, are features that have aided to reduce the time required for making the heats.

A view of several of the molders' benches is shown in Fig. 7. Ample light is provided by an almost continuous row of windows extending around all four sides of the plant. A hydrant has also been placed at every other floor which insures an ample and convenient supply of water to each molder.

Annealing and Cleaning Department.

The annealing and cleaning department is 100 x 300 feet and has two lean-tos, each 16 feet wide and 110 and 96 feet long, respectively. The tumbling mills are located in one lean-to and the annealing ovens are fired in the other. The five ovens are shown in Fig. 6 and the firing room in Fig. 8. These ovens have a capacity of 25 to 28 tons each and their inside dimensions are 16 x 16 x 9 feet. Each oven is provided with seven flues each 4 feet deep and 18 inches wide, and the large side flues insure the proper circulation of the heat. Each oven has two fire boxes 3 feet square and individual flues which lead underground to one stack 100 feet high and 60 inches in diameter. The high stack and large fire boxes, as well as the arrangement of the flues, has materially increased the efficiency of these ovens. The firing room is unusually large and is well ventilated. The coal is handled in buggies which operate on a narrow gage track connecting with the coal storage plant.

FIG. 4—VIEW OF ONE OF THE FOUNDRY BAYS

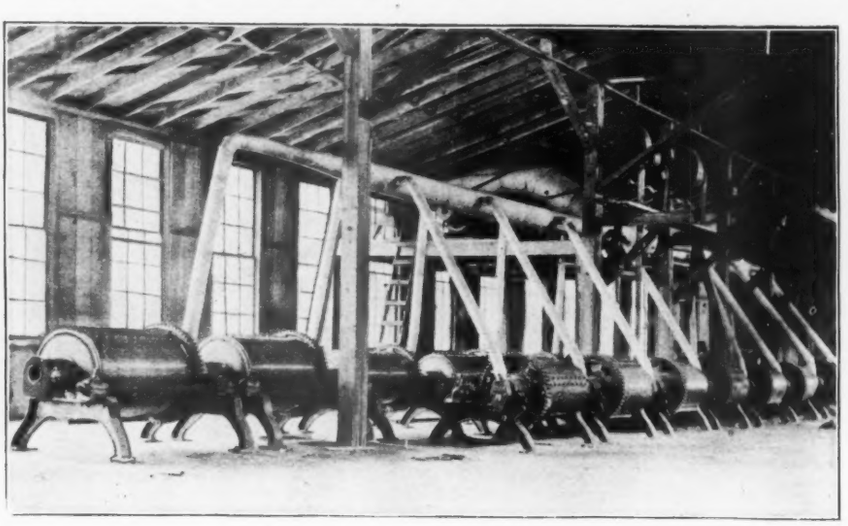


FIG. 5—BATTERY OF TUMBLING MILLS

As the annealing department is not provided with a crane, the heavy oven doors are lifted by the charging truck as shown in Fig. 2. The forks of the truck pass underneath the door which is braced at the top by two bars attached to the truck handle.

Castings Annealed Three Days.

Heavy cast iron bars which remained in the anneal only three days are shown in Fig. 12. The original castings and those subjected to the twisting tests are illustrated in this view. Notwithtanding the thickness of these castings no fractures were developed. Crushed slag from the furnace skimmings forms the only packing material used in this plant, and the results compare favorably with those secured by the use of scale. In addition, the usual cost of

packing material has been entirely eliminated.

Each oven has a capacity of 56 pots which have been cast to uniform size, 24 x 18 inches and 16 inches high. These are stacked four high in the ovens. One of the charging trucks with two pots in position is shown in Fig. 1. It is provided with a rest for the pots and as can be seen, the handle is well braced.

Cleaning Department.

The cleaning department is equipped with 18 tumbling mills installed by the W. W. Sly Mfg. Co., Cleveland. These are connected for operation either in groups or singly as desired, and are shown in Fig. 5. They are belt driven from a center shaft driven by a 20-horsepower motor. The large main exhaust pipes are shown in Fig. 3, the fan being mounted on a platform and is motor driven.

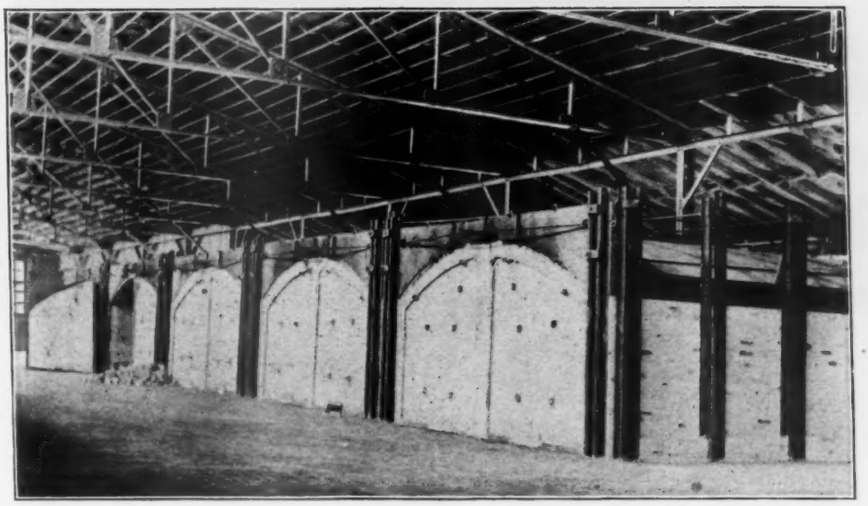


FIG. 6—ANNEALING FURNACES

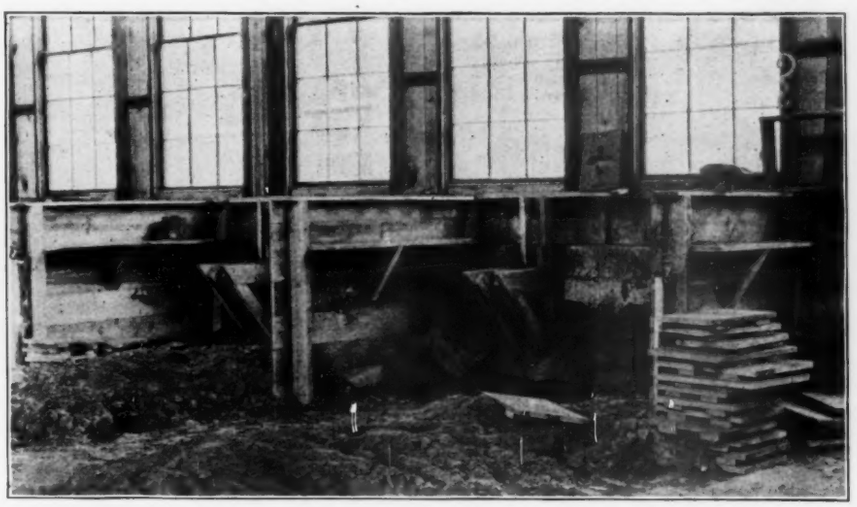


FIG. 7—MOLDERS' BENCHES

Other Departments.

The pattern shop is located in a detached building which parallels the foundry, is 50 x 50 feet in dimensions and is well equipped with wood working tools. The pattern storage vault, 50 x 100 feet, is of fireproof construction and is provided with metal racks and shelves on which the patterns are stored. The core room is 50 x 100 feet and is provided with a sectional stationary core oven 6½ x 12 feet and 6½ feet high. It has doors on both sides and can be fired by either gas or coke. The power house is 40 x 70 feet and is equipped with two 150-horsepower Titusville boilers. A 300-horsepower Corliss engine installed by the Russel Engine Co., Massillon, O., is direct-connected to a 250-kilowatt generator furnished by the Northern Electrical Mfg. Co., Madison, Wis. A. W. Phelps, who has had a wide experience in malleable work in western plants, is manager.

BRASS MIXTURES.

Magnesium if added in small quantities to brass mixtures does not remain in the casting as an ingredient; it absorbs the oxide and by so doing produces a casting of homogeneous structure and perfect density.

Magnesium may be used in oil furnaces as well as in coal and coke furnaces. It is advisable to put a layer of powdered or splintered glass on the surface after the crucible is filled and the deoxidizing process with the magnesium is complete, in order to prevent premature burning of the charcoal covering in oil furnaces. The glass dissolves the thick mass and thus protects the metal against the effect of air and gases. Shortly before the metal is poured, the glassy fluid, together with the cinder and other impurities, should be carefully removed.

COAL CONSUMPTION OF AIR FURNACES.

BY RICHARD MOLDENKE

Question.—What would be the length of time required and the amount of Youghiogheny coal consumed to melt

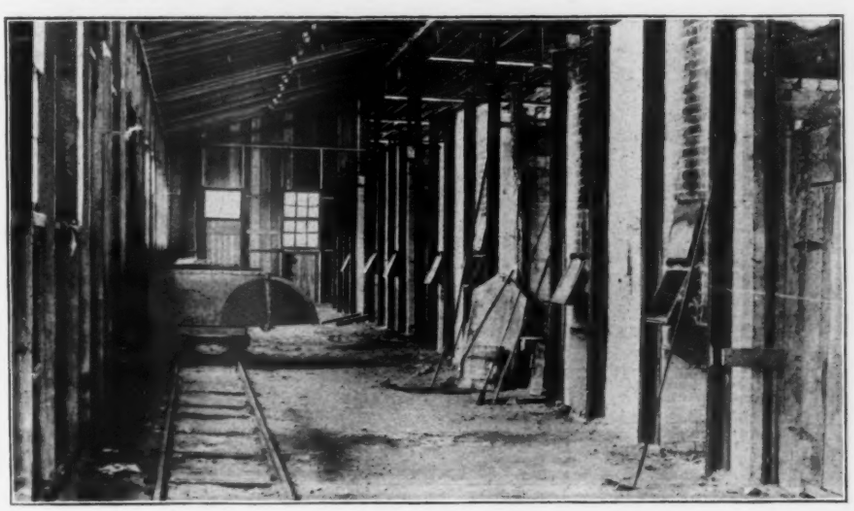


FIG. 8—ANNEALING FURNACE FIRING ROOM

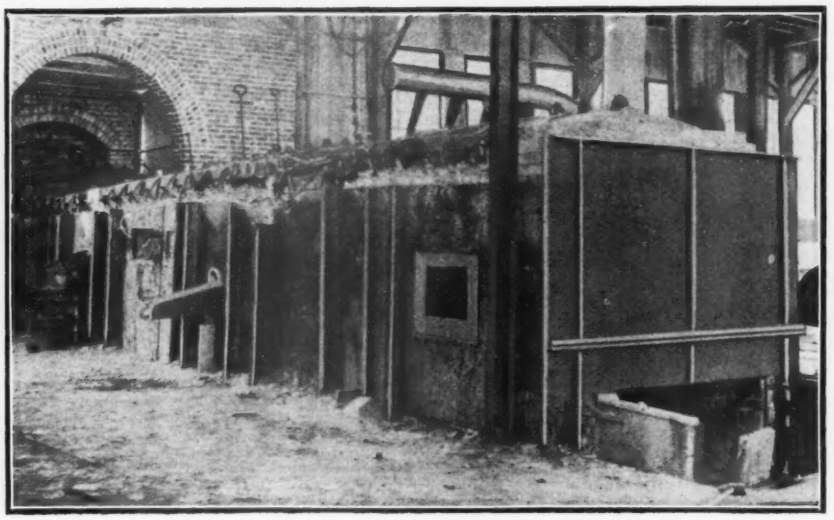


FIG. 9—ONE OF THE MELTING FURNACES

11 tons of metal in a 15-ton malleable melting furnace, with a No. 7 Sturtevant volume blower operating at 1,450 revolutions per minute. We have a 14-inch blast pipe leading to the ash pit and an 8-inch pipe supplying the four 2½-inch pipes passing through the roof of the furnace just back of the bridge wall. We have heard of results as good as four tons to one ton of Youghiogheny coal in furnaces similar to ours.

Answer.—This will naturally depend upon the furnace construction. In a normally designed furnace, the heat ought not take longer than four hours after charging, and the coal consumption should be no worse than four pounds iron to one of coal. However, I have seen furnaces which took six hours to the heat, and used one pound of coal for every two pounds of iron melted. The Youghiogheny coal referred to is of good quality, and if the furnace is built on lines which mean an almost complete combustion of the fuel, there is no reason why the time above given and melting ratio should not obtain.

It is rather interesting to compare the different melting methods for time and fuel consumption. In the cupola 15 tons would normally be taken out in about two hours, the cupola being of a suitable size. The melting ratio, 1 to 8; in the air furnace, the time would be four hours with a ratio of 1 to 4; in the open-hearth three hours with 1 to 6 as a melting ratio.

To show what can be done in the open-hearth, I remember a 10-ton heat being taken out in one hour and 58 minutes after charging. In this case, however, natural gas was used, and this also regenerated. It went so fast that the iron burned and the crown was somewhat affected. The gas was then let in cold, with slightly slower but better results.

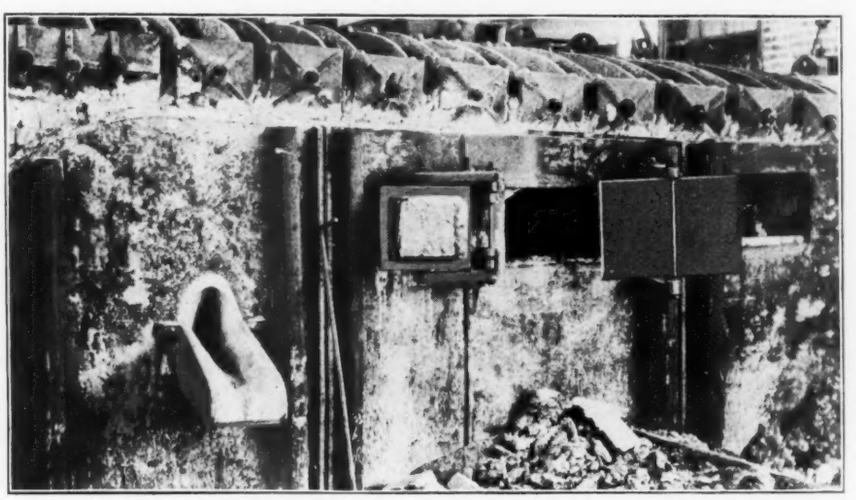


FIG. 10—PIVOTED TEST AND SKIMMING DOORS

FIG. 11—FIRING SIDE OF AIR FURNACE

MALLEABLE CASTINGS ANNEALED IN SCALE AND CHARCOAL.

BY RICHARD MOLDENKE

Question:—I would like to have a comparison of the carbon in malleable castings annealed in roll scale packing and malleables annealed in scale packing with powdered charcoal. Some malleable castings packed with scale and charcoal can be hardened very nicely all the way through and have excellent wearing qualities for use as cams, etc., where the parts are subject to considerable wear and are subjected to practically no strain.

Answer:—The difficulty in hardening castings annealed with scale and charcoal is that some will harden and give excellent wearing qualities, while others will not. Many experiments have been made along this line and many patents have been issued covering this point. As a rule the method is to anneal first in scale in the usual way and to harden later in a bath containing carbon in some form to insure its combination with the iron. The annealed casting when heated to a high temperature and

plunged will always harden from the fact that this again permits the solution of the carbon which the annealing process has driven out. The skin of the casting, however, being lower in carbon than the hardening point of steel requires, will remain soft after plunging. Hence the addition of carbon by artificial means, as suggested in the inquiry. Unfortunately the carbon sometimes gets into the casting, and sometimes it does not, doubtless depending upon the structure of the iron itself. I have seen very excellent milling cutters made from malleable castings in this way and then again, many which were so granular in structure that pressure applied in cutting iron would result in their crumbling. For cutting wood they would answer very well. Those who have made experiments along this line have concluded that steel is cheap enough for edge tools or wearing surfaces, and that no chances should be taken with malleable when the work is important, as it is not a material inherently suitable for the purpose.

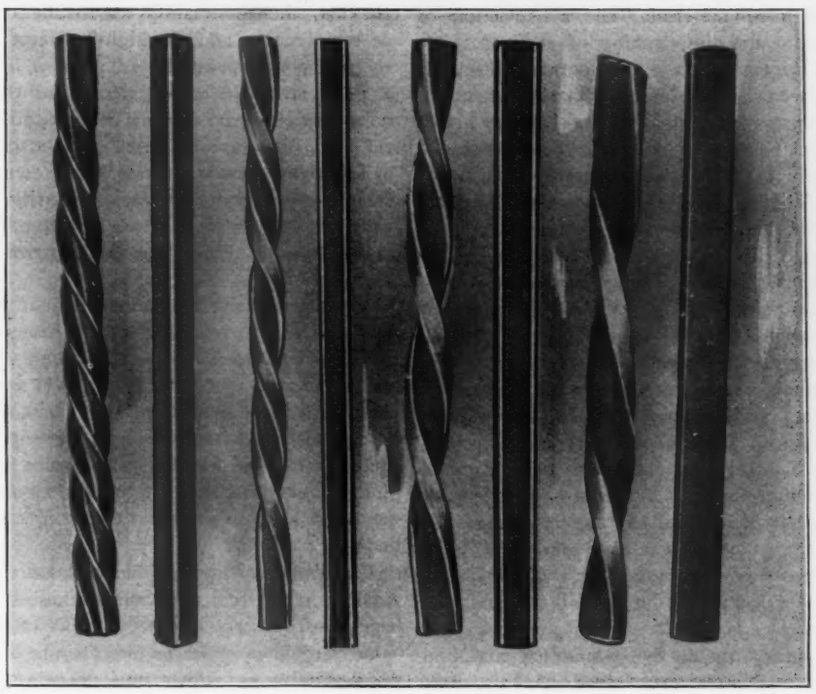


FIG. 12—HEAVY CAST IRON BARS ANNEALED THREE DAYS, TWISTED WITHOUT FRACTURE

WESTERN FOUNDRYMEN'S ASSOCIATION.

Western Missouri, Kansas, Arkansas and Oklahoma foundrymen organized the Western Foundrymen's Association on May 2, at a meeting held at Joplin, Mo. Practically all of the foundries in this territory were represented and the gathering was a most enthusiastic one. Every effort will be made to have the foundrymen west of the Mississippi enrolled in this new society. In a prospectus issued to the foundrymen of the west this announcement is made:

"This association was conceived and organized solely for the benefit of those engaged in the foundry business. It is founded solely on the theory of co-operation, and the practice of mutual assistance. No member is so strong that he is entirely independent of his fellow member. This organization is based on the fundamental principle of 'Strength in unity,' the value of which is demonstrated to us by practical object lessons every day.

"Its purpose is to take up and discuss at the meetings, topics of general interest to the trade looking to the obtaining of better results in foundry practice; the adoption of a form of pig iron contract more advantageous to the foundrymen's interests.

"In the accomplishment of these ends the support of every foundryman west of the Mississippi river is solicited, assuring each one that he will be accorded the same treatment as his fellow member, as there are no special interests to be served, and every one will stand fairly on the same basis."

Officers have been elected as follows: Dr. A. D. Thomas, Thomas, Fordyce Mfg. Co., Little Rock, Ark., president; J. A. Rogers, Rogers-Conklin Mfg. Co., Joplin, Mo., vice president; H. T. Hornsby, United Iron Works Co., Springfield, Mo., secretary-treasurer. The dues have been fixed at $5 per year and the next meeting of the association will be held on June 13 at the Connor Hotel, Joplin, Mo.

PROBLEMS INVOLVED IN THE ERECTION AND EQUIPMENT OF A MODERN FOUNDRY*

BY W. T. HATCH

IN BUILDING and fitting up a foundry, there are a good many questions to be considered outside of the strict art of molding. These questions are very general in character, and although secondary to the main business of the foundry, still exercise a very important influence upon the successful operation. The needs of no two concerns are exactly alike, but as one foundry after another has been built, the treatment of these auxiliaries has been largely determined by previous experience of others, until many of them are now fairly well established. The building of special foundry equipment has also contributed largely to this end.

The foundry of the Brown & Sharpe Mfg. Co. has been built some five years. It is recent enough to be still called modern, and old enough to have allowed for the correction of some of the mistakes in the original design, and the appreciation of some of its good features. Without going into a full description of all its features I will take up some of those only which the inquiries of the builders of later foundries have indicated would be of interest; among these are:

The development, distribution and use of power; the heating and ventilating; the day and artificial lighting; the han-

*Presented at the May meeting of the New England Foundrymen's Association.

dling of materials; the construction of floors and the cleaning of castings.

Referring to the general subject of power, it may be said, that the foundry is provided with both a gas power and a steam power plant; and the power developed is distributed electrically.

The use of gas power is comparatively new, but of much interest. As is generally known, the gas engine with producer gas will develop its power with a fuel consumption of about 1½ pounds of coal per brake horsepower-hour, including the stand-over losses for nights and Sundays.

Gas and Steam Engines Compared.

To do this, however, it must have approximately its full load, but this fuel economy appears to be largely independent of the size of the engine; the results obtained being practically the same from 50-horsepower engines as from 500-horsepower engines. On the other hand, the steam engine under similar conditions will require three to five pounds of coal, and in small sizes, even more. As an offset to the lower fuel consumption of the gas engine compared with the steam engine, is its greater first cost. Figuring on first class equipment in each case, it will be found that a non-condensing steam engine and boiler plant, installed, including foundations, chimneys and auxiliaries, will cost $40 to $50 per horsepower, and a gas engine and gas producer plant, installed, will cost $70 to $80 per horsepower.

Neglecting the greater cost of housing the gas engine plant, on account of the greater size, and the lower cost of attendance on account of the lesser amount of fuel used, it will be seen that the profitable use of the gas engine requires a full load and a long day, in order that its fuel savings may offset its heavy capital charges. Up to the present time, it appears that the gas engine is considerably better developed than the gas producer; evidently the use of natural gas and of blast furnace gas have offered such satisfactory fuels that the attention of gas engine builders has been concentrated on the use of the gas, rather than upon the making of it, and much still remains to be done in the way of the standardizing and perfecting of gas producers, adapted to burning anthracite buckwheat or pea coal. The needs lie in the direction of greater reliability and uniformity of operation, and the difficulties seem to be in numerous mechanical details, rather than in any defect in the theory, and good progress is being made in their removal.

Profitable Use of Gas Engines.

The opportunity for the profitable use of the gas engine will increase as the cost of coal increases, or as inferior grades of coal are found, which can be used in gas producers to better advantage than under steam boilers.

In view of the imperfect condition of the art, the uncertainty as to the cost of maintenance and the high first cost of the gas power plant, its advantages over a good steam plant are much less than would be expected from a comparison of the fuel consumption alone.

The steam power plant in the Brown & Sharpe foundry is installed primarily to provide for the heating of the foundry and to operate the electric lighting generator.

The comparatively small portion of the time in which any large proportion of lighting current is required, makes the steam engine, with its higher fuel consumption, but lower first cost, decidedly more profitable than the gas engine for this service and especially so, since the boilers for the steam engine are already installed as a necessary feature of the heating plant.

The relative cost of installation, as well as of fuel consumption of these two classes of power, has been dwelt on at some length, in order to indicate the limiting conditions which must decide the propriety of their use. In the case of the Brown & Sharpe Mfg. Co.'s foundry, the plan of operation is to run the gas engine to its full capacity the entire day, and to carry the lighting and the peak of the power load beyond the gas engine's capacity, with the steam engine. In this way, the final results are probably better than could be obtained from either a gas or steam power plant alone.

Electrical Equipment.

As previously stated, the power (with the exception of the compressed air) is distributed electrically. It consists of alternating current, three-phase, 60-cycle, 225-volt. This current was adopted on account of the great simplicity of the induction motors, through which it is used. At the time of its adoption, it was comparatively new, and the majority of the electrical experts were advising the use of direct current, but a limited observation and experience had convinced the writer that the use of a large number of direct-current motors was not a step in the direction of simplicity or reduced cost of operation. An experience of some five years with the induction motors has proven entirely satisfactory. At present these motors are used for driving the cupola blowers, elevator pumps, the various wood-working machines in the pattern and flask shops; compressors for sand blast; exhausters for various cleaning operations; sand mixing; clay mill; tumbling barrels and other uses, to the number of 36 motors in sizes from 3 to 50 horsepower, and aggregating 366 horsepower. These motors are mostly used intermittently, and when not in use consume no power; and the fact that the average load for operating them is only about 120 horsepower indicates the large proportional time they are not in actual service. In view of the scattered locations of these motors, the driving of the same machinery from continuously running shafting from a single engine would be very expensive and almost impractical.

The propriety of electrical distribution of power is another of those questions depending on the individual conditions of the case, but in general, where the power is used intermittently and at widely separated points, the use of electrically distributed power will be more economical than its mechanical distribution by shafting and belts.

Lighting.

The artificial lighting of the foundry is done by arc and incandescent lamps supplied with 110 volts, direct current. The same current is also used for electric cranes and hoists.

The daylight supply for this foundry is mainly secured by means of roof lights, the roof being a modification of the sawtooth roof, as used commonly in textile mills. These lights are set in the northerly slopes of the ventilating monitor roof. In this form of skylight, we have the advantage of admitting a large amount of vertical light, the glass being set at an angle of 45 degrees from the vertical, while the ventilating monitor is high enough to protect the glass from the direct rays of the sun. This combination of ventilator and skylight is very well adapted to the needs of the foundry, affording a light remarkably free from side shadows and well diffused. The ventilating monitors are entirely satisfactory as summer ventilation, but give too much air in the winter, and they have been supplemented by a series of Cowl ventilators, which reduce the effect of back drafts. This type of roof lighting was adopted after an inspection of several foundries and shops, in which the glass of the skylights was exposed directly to the rays of sunlight, and it was found that an exposure of this sort was very trying for workmen confined under it. In one instance, it was proposed to cool the skylight by providing automatic sprinklers to flow water over the surface; in another instance, the glass had been painted a dark brown; and in a third, the skylight was covered with canvas; these cases being observed within a few weeks, suggested the importance of admitting *skylight* instead of direct *sunlight,* and the form adopted has proved entirely satisfactory.

Cleaning Castings.

On the subject of cleaning castings, it may be said that, until quite recently, this work has been done by means of pickling and tumbling; both of these methods are well known and reliable, but more recently there has been a strong demand for cleaning by means of the sand blast.

It is thought by many that a sand blasted surface will hold paint more firm-

ly than the surface cleaned by pickling. Some two years ago, our attention was called to the use of sand blast tumbling barrels. These are adapted to cleaning comparatively small castings.

Sand Blast.

This apparatus includes a supply of compressed air at 15 to 20 pounds pressure and an elaborate exhaust system for the continuous supply of sand and for the removal of fine dust. This fine dust has been difficult to control, but this has finally been accomplished by passing it through a wet scrubber, as it is called. This scrubber consists of a stack or trunk about 7 feet square and 25 feet high. This stack stands in a water-sealed base and is fitted with a series of wooden racks or slots, over which a flow of water is circulated by means of a centrifugal pump. These racks are so placed as to break up the passage of air through them. They offer a very large area of wet surface to the dust-laden air, and in passing through them the dust is practically all deposited on the wet racks and is washed to the bottom, from which it is removed from time to time. This wet scrubber receives the dust, not only from the sand blast barrels, but also from the regular tumbling mills and, while it is not strictly speaking an essential part of either, the total amount of dust discharged is so great as to constitute a serious nuisance if blown out into the open air and, except in any isolated situations, some efficient dust separating device must be provided.

The work done by the sand blast barrels is very satisfactory in both quality and quantity, and the direct labor cost is no more than the cost with ordinary tumbling barrels, but the cost of installation and the cost of maintenance are both high. The installation of the sand blast barrels must, therefore, be justified by quality of the work done, rather than by its cost.

Sand Blast for Large Castings.

During the past year, the question of applying the sand blast to machine frames and other castings too large for the barrels was taken up—after repeated postponements on account of the dust nuisance, which, within the writer's observation, has more than balanced its advantages.

The question was not as to the merit of the sand blast, but as to the feasibility of taking care of its dust and dirt, and operating it under fairly comfortable conditions for the operator. The arrangement of this installation will be of interest, because we have made it successful to this extent.

The sand blasting is done in a room built within the cleaning room proper. This room is 15 feet square and 8 feet high. The work to be cleaned is suspended from an overhead tramrail with an electric hoist.

A slot in the roof of the room allows for the proper placing of the piece to be sand blasted, and the roof of the room protects the hoist from any injury. The room is ventilated by means of a Sturtevant steel plate exhauster with 18-inch suction and discharge connections. This exhauster is run at 1,260 revolutions per minute, and gives a free circulation of air through the room. Air is admitted to the room from the opposite side and as near to the operator as possible. The intention is to supply the operator with ample fresh air and to draw the dust away from him. The space between the operator and the dust outlet on the opposite side of the room is some 10 feet, and gives time for the sharp sand to fall to the floor, so that only the light floating dust is drawn out of the room. The sand can thus be easily shoveled up and used over repeatedly. The dust is discharged through a wet scrubber, similar in principle to the one used for collecting the dust from the sand blast and other tumbling barrels. The fitting up of this sand blasting room, including its exhauster, its motor and wet scrubber, has been quite an expense, to say nothing of the power required to operate the sand blast and the exhauster; still the quality and quantity of work done with this apparatus are very satisfactory, and if it be admitted that sand blasting is necessary, I believe our installation must be considered a success. As in the case of the sand blast barrels, however, the cost of installing, operating and maintaining the sand blast apparatus is high, and the quality of the work done, rather than its cost, must be the reason for its adoption.

Handling Material.

The question of handling material in the foundry is dependent on numerous conditions, and I will first refer to such material as may be handled in trucks and barrows, or on cars and industrial tracks.

The question was carefully studied when planning the handling of pig iron between the pig iron storage and the cupola charging floor.

It was at first assumed that the tracks with cars constituted the best possible method, but it was soon found that any system of tracks was quite expensive to install and not flexile enough, in use, to give satisfactory results. It was finally decided to build a smooth floor and use special trucks with large wheels and roller bearings. We built a number of these charging trucks, with platforms about 24 inches high and with their wheels 20 inches diameter by 4-inch face. These wheels run on simple roller bearings made dust-proof, and it is practicable for one man to move 2,000 to 3,000 pounds of pig iron without difficulty. These trucks have been in use some five years, and by taking the trouble to make the roller bearings dust-proof to start with, they have not yet required any general repairs, and are nearly as good as new. For the area served and the distance the pig iron is moved, the use of these trucks is less expensive and more satisfactory, in many ways, than any arrangement of cars and tracks.

Floors.

In connection with the handling of materials, the adoption of tracks in place of rails and cars has necessitated good floors, and considerable study has been given to these. The molding rooms and core rooms have floors of cement concrete with a granolithic top surface.

The alleyways in which most of the tracking is done are covered with cast iron plates. The pig iron storage and the cleaning room have wooden paving blocks about 4 inches long, laid with grain running vertical, so that the wear comes on ends. So far as the cement floors in the molding rooms are concerned, it may be said that they have worn very well, but it is found necessary to protect them against the spilling of hot iron from the pouring tables by a thin coat of sand, which is the simplest the best protection I know of. The cast iron plates make very satisfactory alleyways for the molding rooms; of course, they become drawn in time, but it is not very expensive to remelt them when necessary. The block pavement for the pig iron storage and for the cleaning room is the same that is in use on several bridges and some city streets. While it is quite expensive to put down, requiring as it does a solid foundation, it is very satisfactory in use, and from present indication will stand the severest service for a long term of years without serious injury.

Traveling Cranes.

A reference to the handling of materials would be incomplete and misleading without a reference to the system of traveling cranes and tramrails with which this foundry is equipped. The foundry has two molding rooms, one for crane or heavy work, and the other for light machine and bench work. The room for heavy work is entirely covered by traveling cranes. The largest crane is of 10 tons capacity and covers an area of 30 by 160 feet. It is operated from a cage and all its motions are electrical. In addition to serving the heaviest molding floors, it also distributes the ladles from the cupola to the eight five-ton cranes which flank its side. These five-ton cranes have electric hoist only; both their traveling motions being operated by hand from the floor. These cranes cover areas of 20 x 60 feet, and furnish ample service for molding floors of

this size. These eight cranes cover an area of 160 feet long by 60 feet wide. When designing this service, the writer was urged by some crane builders to cover it with three electrically operated cranes to cover 20 feet by 160 feet each. The fact, however, that the crane service of the molding floor often requires quite long periods of time, has shown the slower moving floor operating cranes to give much more satisfactory service, the waiting being quite as important as the traveling.

Crane Equipment of Light Molding Shop.

The light molding room is framed to carry light traveling cranes of two tons' capacity, but only a relatively small portion is covered by them over the heavier molding machines. Similar hand traveling cranes with electric hoists of one to five-tons' capacity are installed in the core room, the pickle room, the sand blast room, the cleaning and delivery room, and store rooms wherever loads to be lifted are beyond the strength of two men. These small cranes are not very expensive, costing less than $200 each without electric hoists, and not over $500 with hoists. The needs of this foundry are to handle a very large number of comparatively light loads, and these light traveling cranes have been found extremely useful.

The handling of the hot iron in the light molding room should be mentioned. This is done on two systems of overhead tramrails, each having

FIG. 1—FOLDING DOOR STOVE BUILT IN 1845.

one outgoing and returning rail with numerous crossovers extending from the cupolas to the extreme end of the foundry. This service is designed on the theory of getting the iron from the cupola to the flask in the shortest possible time. The iron flows continuously from the cupola into a reservoir or mixing ladle, which empties into the trolley or distributing ladles without changing the height

FIG. 2—PARLOR STOVE BUILT IN 1845

of either. These trolley ladles are of 800 pounds capacity, and are moved along the tramrail by a single laborer at a rapid walking pace. These ladles are hung at a height to allow them to empty into the single or double hand ladles on the floors. The outgoing track is always kept open, the ladles standing on the return track when being poured off.

In making these fragmentary references to the auxiliaries of the foundry, it has been difficult to make exact statements, perhaps it is unnecessary, but the conclusions seem to be well supported by experience.

THREE PIONEERS OF THE CANADIAN STOVE TRADE.

The three artistic stoves shown in Figs. 1, 2 and 3, built more than 60 years ago, are conspicuously displayed in the show rooms of the Gurney Foundry Co., Ltd., Toronto. Two of the stoves, Fig. 1 and 2, were built in 1845 and the third in 1847 by the founders of this concern, who graduated from their apprenticeship in the shops of J. S. & M. Peckham, Utica, N. Y. The Gurney Bros. moved to Hamilton, Ont., in 1843, and there began the manufacture of stoves in a modest way, although their product reflected unusual ambitions along artistic lines. While there is no record of the patterns, it is believed they were made in Albany, N. Y., and it is evident that the designer sacrificed utility for appearance. The stove shown in Fig. 1 is provided with folding doors, and the one shown in Fig. 2 has the fire and ash door at the side. The stoves, while reflecting credit on the skill of the molders of that early day, did not find a ready market as they were too expensive and could not be sold in competition with the common stove of the box type in general use at that time.

BRITISH FOUNDRYMEN'S ASSOCIATION.

The Birmingham branch of the British Foundrymen's Association held its second annual meeting and smoking concert at the Acorn hotel, Birmingham, Saturday evening, April 25. R. Mason presided in the absence of R. Buchanan, president.

The chairman congratulated the members on a successful season, their numbers having increased from 52 to 104. The income had more than met the expenditure, and they had had an excellent series of lectures and papers furnished in most cases by local members and experts.

FIG. 3—PARLOR STOVE BUILT IN 1847

Officers were then elected, R. Buchanan being re-elected president, and Mr. Heggie, secretary. A new office was created by the election of R. Mason, vice president. E. B. Grover was chosen auditor. Messrs. Crump, A. Fraser, G. Hailstone, F. J. Cook and Craig, form the council.

EXHIBITION PARK, TORONTO, WHERE THE FOUNDRYMEN'S CONVENTION WILL BE HELD

PREPARATIONS FOR THE TORONTO CONVENTION, PAPERS AND DISCUSSIONS, PROGRAM AND EXHIBITION FEATURES

TORONTO will be the center of attraction for American foundrymen during the second week in June. Elaborate preparations have been made for this annual meeting and the indications are that the attendance will exceed that of the Philadelphia gathering last year. Papers will be read and practical subjects discussed by the members of the American Foundrymen's Association and the American Brass Founders' Association, while the Associated Foundry Foremen will hold their annual meeting and election of officers, and the Foundry Supply Association will conduct an exhibit that promises to be unusually attractive.

The Process building and Machinery hall, at Exhibition Park, have been converted into a model foundry where the latest appliances and equipment will be displayed. The advancement in molding machine practice during the last 12 months has been almost revolutionary, and practical demonstrations of the use of these improved machines will be made. The operating exhibits will be located in Machinery hall and in a temporary building adjoining it. Here a cupola will be operated and daily heats will be made. A core oven has also been erected for baking cores and non-ferrous metals will be melted in oil melting furnaces.

A French cupola, of special design, has been installed by J. de Clercy, Montreal. This melting installation will prove of special interest, owing to the fact that it has been planned to operate the cupola for an hour or two in the morning, to shut it down during the lunch hour without dropping bottom and to continue melting in the afternoon. Blast will be furnished by a Sturtevant turbine blower set furnished by the B. F. Sturtevant Co., Hyde Park, Mass. This cupola will prove of special interest to foundrymen who desire a small amount of iron at intervals throughout the day. It can also be used to advantage in plants where automatic molding machines are used and where the floors fill up so rapidly that it becomes necessary to melt almost continuously.

Convention Program.

Monday evening, June 8. — Annual meeting of the Associated Foundry Foremen.

Tuesday afternoon, June 9.—Formal opening of the convention and exhibition. Joint meeting of the American Foundrymen's Association, American Brass Founders' Association, Associated Foundry Foremen and the Foundry Supply Association.

Tuesday evening, June 9.—Official Reception at the City Hall.

Wednesday morning, June 10.—Exhibition closed while the meetings of the associations are in progress. The American Brass Founders' Association will hold a meeting in a separate building.

Wednesday afternoon.—Business sessions of the American Foundrymen's Association and the American Brass Founders' Association.

Wednesday evening.—Open.

Thursday morning, July 11.—The exhibition will be closed during the business sessions of the associations.

Thursday afternoon.—Business session.

Thursday evening.—Moonlight excursion.

Friday afternoon, June 12.—Trolley ride.

Friday evening.—Smoker.

Molding Machine Display.

The molding machine display will prove unusually complete, and many new types will be shown. Procuring molding sand of a suitable grade and then keeping the sand in condition are two difficulties which fall to the common lot of foundrymen. Machines to overcome these difficulties will be shown, and one French sand mill has been shipped from France for this exhibition. There will also be two very interesting demonstrations of the method of fitting patterns to molding machines. One concern will make souvenir castings from carefully prepared patterns furnished by C. J. Caley, manager of the Russel-Erwin

Co., New Britain, Conn. This exhibition will prove a revelation in the way of molding machine accomplishments, especially in the production of fine castings.

Other equipment, such as tumbling barrels, sand blast machines, etc., will be shown in operation. Sand handling and mixing machinery, handling appliances and all kinds of handy foundry rigging will be exhibited.

The Process building will contain a large number of working models, as well as extensive still exhibits. The exhibition buildings will be unusually well equipped this year with offices and booths where delegates can rest and meet their friends and representatives of the exhibitors. Many of the firms exhibiting in both buildings are preparing special features for the entertainment of the visitors.

The arrangement by which meetings will be held in the auditorium of the Dairy building, located near the exhibit buildings, will make it possible for the members to spend the entire day on the grounds. Arrangements have been made with a high class catering company, so that the delegates will not be compelled to leave the grounds for their meals.

This year, the custom established in the past will be followed and the entertainment features will be limited to members of the several associations. The meetings for reading and discussing papers will be open to all, but a small charge for admission to the exhibit will be made to non-members of the associations. Members of any one of the associations will be admitted free to the exhibit and will also participate in all the entertainment features.

Headquarters.

Headquarters of the American Foundrymen's Association, Foundry Supply Association and the American Brass Founders' Association will be established at the King Edward hotel. The headquarters of the Associated Foundry Foremen will be at the Palmer house, King and York streets.

The membership of the Associated Foundry Foremen has experienced a remarkable growth during the year, no less than 80 foremen having been enrolled. A new local has also been organized at Davenport, Ia., by James F. Webb, president of the organization. The revision of the constitution will be taken up and methods of managing the affairs of the association will be discussed. A number of interesting changes are suggested and a large attendance is anticipated. F. C. Everitt, secretary of the association, will arrive in Toronto on June 7 and he has requested that all mail addressed to him after June 4 should be sent to the Palmer house. The registration booth will be located in front of the main entrance to the Process building.

Several committees of foundrymen from Detroit, Pittsburg and Cincinnati will attend for the purpose of presenting the advantages of their respective cities as the convention places during the next three years. Cincinnati has been practically decided upon for 1909, and the Detroit foundrymen are anxious for the meeting the ensuing year. The Pittsburg foundrymen are likewise anxious to entertain the associations in 1910, but if this cannot be satisfactorily arranged, they will urge the members to meet in the smoky city in 1911.

American Foundrymen's Association.

PAPERS AND DISCUSSIONS.

"The Prevention of Accidents in the Foundry," Thomas D. West.
"Core Sands and Mixtures," A. M. Loudon.
"Coke Making for the Foundry," Dr. Richard Moldenke.
"Annealing Castings," W. M. Carr.
"Foundry Warehouse Methods," F. C. Everitt.
"Patternmaking for the Specialty Shop," H. M. Lane.
"The Elimination of Foundry Waste," H. Emerson.
"Shop Betterment," H. F. J. Porter.
"Oxy-Acetylene Welding of Castings," S. H. Taylor.
"Notes on Cupola Practice," Prof. H. McCormack.
"Titanium in Cast Iron," Dr. Richard Moldenke.
"Ferro-Alloys in the Foundry," W. M. Saunders.
"Cupola Thermics," S. H. Stupakoff.
"Specifications for Castings to be Machined," H. E. Diller.
"Foundry Transportation Methods," David Goehr.
"Further Notes on Sandless Castings," V. B. Lamb.
"Report of Cost Committee," Kenneth Falconer.

Discussions.

"Pig Iron Specifications."
"Machine Molding," E. H. Mumford.
"Use of Turnings and Borings in the Foundry."
"Automobile Cylinder Making."
"Thermit in the Foundry."
"Ethics of Selling Castings."
"Clamping Molds."
"Sea Coal Facings."
"Radiator Cores."
"Cast Iron for Mine Water."

The list of exhibitors follows:

ARCADE MFG. CO. Freeport, Ill.—Three new types of molding machines will be shown in operation by this concern, including a large automatic machine which was recently introduced to the foundry trade; two styles of rock-over machines and a No. 3 "Modern" machine.

BAIRD & WEST, Detroit.—This concern will furnish Solvay process coke for the cupola.

BALLOU'S WHITE SAND CO., Millington, Ill.—Various grades of foundry sands mined and prepared by this concern will be shown in the booth of the Hamilton Facing Mill Co., Hamilton, Ont. This will include natural magnesia core sand, white, washed silica furnace sand, fire and silica molding sand, sand blast, silica core, steel casting and yellow silica sand. The natural magnesia core sand will be shown in actual use in the booth of the Falls Rivet & Machine Co., as well as in the exhibit of the Diamond Clamp & Flask Co.

BERKSHIRE MFG. CO., Cleveland.—Automatic molding machines will be shown in operation, including the Berkshire improved machine. Patterns of different kinds will be mounted to demonstrate the adaptability of this machine to various classes of work.

BUCH'S, A., SONS CO., Elizabethtown, Pa.—No. 2 gravity molding machine, which will be shown in operation, demonstrating the various classes of work to which this machine is adapted, and various patterns will be mounted.

BUFFALO FORGE CO., Buffalo.—The exhaust fan that will remove the dust from the polishing wheels in the exhibit of the Osborn Mfg. Co., will be furnished by this concern.

CALUMET ENGINEERING CO., Harvey, Ill.—The Calumet cupola will be shown as well as other foundry equipment, including ladles, tumbling mills, etc.

CANADIAN GAS POWER AND LAUNCHES, LTD., Toronto.—Gas engines for driving a Crocker-Wheeler generator for furnishing current to the exhibitors.

Canadian Machinery, Toronto.

CARBORUNDUM CO., Niagara Falls, N. Y.—Grinding wheels and abrasive material.

Castings, Cleveland.

CLERCY, J. DE, Montreal.—The Baillot cupola, which will supply iron to the molding machine exhibitors, will be furnished by this concern. The cupola will be supplied with blast from a steam turbine driven Sturtevant blower set.

CLEVELAND TUMBLING BARREL & MFG. CO., Cleveland.—The tumbling mills made by this concern will be exhibited by the J. S. McCormick Co., Pittsburg, Pa.

CLEVELAND WIRE SPRING CO., Cleveland.—This exhibit will consist of steel boxes, barrels, barrel trucks, core trays, shop stools, shelving, etc., for foundry use.

DETROIT FOUNDRY SUPPLY CO., Detroit.—Molding machines, which will be shown in operation and a full line of foundry supplies.

DETROIT TESTING LABORATORY, Detroit.—The booth of this concern will be placed at the disposal of visiting foundrymen. A testing machine and several other pieces of apparatus used by chemists and engineers will also be exhibited.

DIXON, JOS., CRUCIBLE CO., Jersey City, N. J.—Brass and steel foundry crucibles. Pots that have been used for a large number of heats will also be shown.

DOMINION FOUNDRY SUPPLY CO., Montreal.—All kinds of foundry supplies made by the S. Obermayer Co., Cincinnati.

FALLS RIVET & MACHINE CO., Cuyahoga Falls, Ohio.—Full line of core machines, core cutting-off and coning machines, core oven and other foundry equipment.

FOUNDRY, THE, Cleveland.

FOUNDRY SPECIALTY CO., Cincinnati.—

In this exhibit will be shown "Fluxine" and "Partine," two of the foundry products made by this concern. The former is used as a flux for non-ferrous metals and "Partine" is a parting compound.

FOX MACHINE CO., Grand Rapids, Mich.—This exhibit will contain a complete line of pattern shop equipment, including wood trimmers and a new core box machine.

GOLDSCHMIDT THERMIT CO., New York.—Titanium-thermit cans for purifying molten iron and steel and semi-steel cans for reviving dull iron and melting steel borings in gray iron for the purpose of making semi-steel castings. Appliances will also be shown for welding wrought iron and steel sections, butt-welding pipe and repairing castings. Pure metals produced by the alumino-thermic process, such as manganese, chromium, molybdenum free from carbon, and manganese copper free from iron, ferro-vanadium, manganese zinc, ferro-titanium, ferro-boron, will also be shown.

GREGG CO., Cleveland.—Wire straightening and cutting-off machine.

HAMILTON FACING MILL CO., LTD., Hamilton, Ont.—Foundry facings, plumbago, molding sand, pressure blowers, tumbling mills, sand sifters, core machines, core ovens and molding machines.

HAWLEY DOWN DRAFT FURNACE CO., Chicago.—Complete line of Schwartz metal melting and refining furnaces in sizes ranging from 300 pounds per heat up to the large size, having a capacity of 12,000 pounds per heat. These furnaces will be shown in operation under pressure, but no metal will be melted. This exhibit will also contain a complete line of castings, brass, bronze, aluminum, iron and steel made by these furnaces by the various manufacturers throughout the country.

HERMAN PNEUMATIC MACHINE CO., Zelienople, Pa.—A jarring molding machine 24 x 45 inches, provided with a complete turn-over arrangement for drawing patterns, will be shown in operation. The machine is well adapted for jobbing foundry work and is of the plunger type.

HILL & GRIFFITH CO., Cincinnati.—Complete line of foundry supplies and equipment.

HOLDEN, N. J., CO., LTD., Montreal.—This concern, which is the Canadian sales agent for the Chicago Pneumatic Tool Co., Chicago, will install a Franklin air compressor to furnish compressed air to all of the exhibitors. Chipping, caulking and riveting hammers will be shown in operation, as well as a piston air drill.

HOLLAND LINSEED OIL CO., Chicago.—This concern will have a working exhibit and will make cores with Holland core oil in the mixture and will bake them in some of the ovens that will be shown. The cores will later be set into molds, which will be cast, giving a practical demonstration of the qualities of this core oil.

INTERSTATE SAND CO., Cleveland.—This concern will furnish the sand used by the molding machine exhibitors.

KILLING'S, E., MOLDING MACHINE WORKS, Davenport, Iowa.—This concern will operate three different sizes of its new roll-over straight drop molding machines; a stripping plate machine, roll-out machine, automatic flasks, steel jackets and a universal saw table.

KOPPEL, ARTHUR, CO., Pittsburg.—Industrial railway systems and industrial cars.

KROESCHELL BROS. CO., Chicago.—The Kroeschell-Schwartz gyrating flame crucible furnace for melting non-ferrous metals will be shown in operation.

LINDSAY, W. W., Philadelphia.—Complete line of chaplets for foundry use.

MITCHELL-PARKS MFG. CO., St. Louis.—Gravity molding machine and other foundry equipment.

MONARCH ENGINEERING & MFG. CO., Baltimore.—This concern will have a working exhibit and will operate a No. 6 Monarch low pressure blower, driven by a No. 8-horsepower electric motor. The other exhibits will include ladle heaters; Steele-Harvey crucible brass melting furnace; one improved lifting-out crucible type of furnace with a pipe attachment; one regular Steele-Harvey non-tilting furnace; one soft metal pot furnace for melting lead or tin; one rivet heating furnace, and a core oven heated by Monarch oil burners.

MUMFORD, E. H., CO., Philadelphia.—A French sand mill will be shown in operation, milling sand for foundry use; one R. 3 French molding machine with pump and accumulator will also be shown and demonstrations will be given of making French stripping plate patterns, as well as the Cliche patterns.

McCORMICK, J. S., CO., Pittsburg.—Exhaust tumbling barrels, Millett portable core oven, Farnham sand blast machine and a full line of foundry supplies. A bicycle consisting of foundry tools used by molders will also be displayed. A folding, 3-foot rule will be mailed to all foundrymen registering at this booth.

American Brass Founders' Association.

PAPERS AND DISCUSSIONS.

"The Value of Liquid Fuel in Brass Foundry Practice," W. N. Best.
"The Efficiency of Brass Melting Furnaces," F. A. Coleman.
"The Metallurgy of the Bronze Age in Europe," W. M. Corse.
"Modern Appliances and Processes in Foundry Work," F. H. Dimock.
"Quality versus Quantity," J. N. Gamble.
"Prolonging the Life of a Crucible," Dudley A. Johnson.
"The Outside versus the Inside Man," W. A. Porter.
"The Electro-Chemical Cleaning of Metals and Its Application to Commercial Uses," Chas. H. Proctor.
"Oil as Fuel," W. S. Quigley.
"The Relation Between the Chemical and Physical Characteristics of Molding Sands," Dr. Heinrick Ries.

NORTHERN ENGINEERING WORKS, Detroit.—This booth will be decorated with photographs of a variety of Northern cranes, especially the three and four-motor electric traveling cranes, as well as photographs of the Newten cupola and various types of foundry ladles, core oven equipment, foundry elevators, tumbling barrels, electric hoists, etc.

OBERMAYER, S., CO., Cincinnati.—Foundry supplies and equipment. This booth will also contain the exhibit of the Dominion Foundry Supply Co., Montreal.

ONTARIO WIND ENGINE & PUMP CO., Toronto.—Exhibit of the gravity molding machine.

OSBORN MFG. CO., Cleveland.—Wire brushes and other foundry supplies. Demonstrations of wire brushes cleaning castings will be made.

PAXSON, J. W., CO., Philadelphia.—Samples of foundry supplies, wire and bristle brushes, riddles, bellows, rammers, tongs, wax tapers, clamps, chaplets, core brushes, pattern-makers' supplies, etc. A magnetic metal separator that can be operated either by hand or power will be shown in operation, separating iron from brass turnings. Iron, brass and steel castings that have been thoroughly cleaned by the Paxson-Warren system will also be displayed. This exhibit will also contain a No. 3, Paxson fan blower, as well as a new plunger type of core machine in operation. Other features include aluminum pattern plates, knee pads, vibrators, blow valves, tub vibrators, pneumatic suction cleaners and a Paxson rock-over molding machine making stove plate.

PRIDMORE, HENRY E., Chicago.—Molding machines in operation, including one small rock-over drop machine fitted up for molding pulleys; one large rock-over drop machine fitted up for molding tees; one plain rock-over machine fitted up for molding stove plate; one plain rock-over machine fitted up for molding hollow ware, and two square stand machines fitted up for molding gears.

ROBESON PROCESS CO., Au Sable Forks, N. Y.—Barrels of glutrin will be shown and this binder will be used for making cores to demonstrate its qualities.

ROCKWELL ENGINEERING CO., New York.—Double-chamber melting and tilting crucible furnaces, which will be operated with a fan blast at 12 ounces pressure.

ROOTS, P. H. & F. M., CO., Connersville, Ind.—Positive pressure foundry blowers.

SEIDEL, R. B., Philadelphia.—Brass and steel foundry crucibles.

SMITH, J. D., FOUNDRY SUPPLY CO., Cleveland.—Stationary core oven equipped with five rolling drawers and one core car. The core oven will be erected on the grounds and will be shown in operation. Two new types of sand riddling machines will also be shown, as well as a molding and a sand blast machine.

SLY, W. W., MFG. CO., Cleveland.—New gear cutter for pattern shop use, resin and cleaning mills, dust arrester, cinder mill, friction clutch pulley and other foundry equipment.

STANDARD SAND AND MACHINE CO., Cleveland.—This exhibit will include one portable automatic mixing plant which can be used for mixing any kind of foundry sand, and is especially adapted for mixing loam. This machine can also be used for mixing concrete and is built for heavy duty; one No. 4 standard, continuous mixer equipped with an oil heater and an oil meter, as well as a spraying attachment for mixing sand for oil cores; one No. 2 and one No. 0 batch mixers; one direct motor-driven, portable centrifugal mill for cutting over the sand on floors; one upright stationary sand mill; one stationary centrifugal mill, and one small centrifugal mill; one direct motor-driven foundry screen fitted with a lever for adjusting the pitch of the screen; and one section of a belt conveyor and other small parts of machines built by this concern.

STEVENS, FREDERIC B., Detroit.—Complete line of foundry supplies.

STURTEVANT, B. F., CO., Hyde Park, Mass.—The new turbine blower set made by this concern will furnish the blast for the French cupola, which will provide the iron for casting the molds made by the molding machine exhibitors. It is the intention of the exhibitors to operate the cupola in the morning, bank it for two hours at the lunch hour and then operate it again for two hours in the afternoon. This will give the visitors an opportunity of seeing the Sturtevant blower set in continuous operation for several hours and demonstrations will be given of starting and stopping it at will with a minimum of attention. The turbine, as a means of driving the blower, is a new application of this device, and has many advantages,

in view of the fact that no belts or gears are required. The set that will be shown is direct-connected. Another interesting feature connected with this exhibit will be the method of heating the air for the blast. The air supply is drawn through a hollow shell surrounding the cupola just below the charging door. The blower, therefore, must handle air at a temperature far in excess of that ordinarily used. The fan blower will readily handle air at this temperature, and the turbine is so constructed that the heat will not detract from its successful operation.

TABOR MFG. CO., Philadelphia.—The molding machines shown in operation will include a power squeezing vibrator frame molding machine; power squeezing split pattern vibrator molding machine; hand ramming hinged machines in several sizes, and two new power squeezing hinged molding machines and a power roll-over power pattern draft hinged machine.

WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill.—Cupolas, tumbling mills, cranes, and a full line of other foundry equipment.

THE FOUNDRY CONVENTION IDEA.[1]

BY E. H. MUMFORD[2]

WHY do we attend conventions? Is it to have a good time? If so, we can all think of ways of having the same kinds of fun nearer home. Some of us come to advertise, but there would be no object, if only advertisers came. Still, with the two purposes—to show and to be shown—inhabitants of other states than Missouri expatriate themelves at June conventions; and from those who come to see, and those who are sent to see for those who cannot come themselves, are recruited the fundamental motives for conventions. The advertisers or supply men simply bring material things for very material and worldly reasons. It is by a study of the deeper reasons for the gathering of men in conventions of specialists that we may get at the fundamental idea of the foundry convention, and possessed of this, unconsciously make the convention ideal.

No man, be he ever so able, can accomplish his complete work in the world without suggestion or advice from other men's experiences.

In an absolutely open country or in a level forest it is said that a man without a compass, traveling alone on a cloudy and still day, moves in a circle and returns to his starting point with nothing accomplished. It is evident that if in that country there were an eminent landmark, such as a very tall tree or a mountain, as long as he held such a reference point in sight or felt the slope to the mountain under his feet, by knowing where the tree or the mountain was, he might by so much regulate his course and his "circle" would be distorted so that he would make a little advance, though with only one mountain or only one tree his chances of arriving at any destination would be infinitely small.

I am speaking of a wide-awake, thinking man. Nothing can guide the man who during his trick at the wheel slumbers for a moment, loses his star, and calls the skipper on deck to give him another because he has passed that one. Such a man can't hold a course any way and will always work for cabin boy's wages.

But the men who travel hundreds of miles to attend foundry conventions are not of that type.

For men who can read, signs are erected by other men; for men who can talk, other men can point out the way; for a man who can think, even inanimate things will come together into his intelligence so that he may travel through them and attain a great destiny in the vista of experience.

But one mortal man alone without association with other men or what they have done would lead a small enterprise in an aimless, narrow path through a lifetime of honest effort, and the record of all his work would show less value created than the work of a single bee in the organization of a hive.

It is as true of the individual industry as it is of the individual man that it cannot isolate itself and succeed. It may be pre-eminent in its special manufacture; its wares may be without a single competitor. It may feel secure in its future because of its past and declare to itself and others that no other can supplant it in the markets of the world, while, even at the moment when its head is buried in its arrogant pride in individual independence, a new industry based on a synthetic development of public knowledge in its own specialty, is exhibiting the first made machines or processes in a new line destined to supersede the old.

So far we have considered superficial, evident and more or less selfish motives for meeting our associates in convention assembled. To advertise, to show, to be shown, to benefit individually by the counsel of others, to survive in competition by keeping informed of competitors—all these are selfish reasons for populating conventions. And yet through such less worthy motives most of the greater purposes of the world as of conventions are worked out.

The success of an individual manufacturer of a valuable product means much to the world, and, if only he will give as much as he receives at the convention, his selfish interest in, or contribution from it, is made whole in the giving. Anything that helps a man or an industry to add value for his fellow men, no matter how eagerly or selfishly sought, fulfills its higher destiny.

But there is yet a larger idea in our foundry convention. Let us study it. Let us seek it.

In the early days of the molding machine in this country the iron molders deliberately chose to ignore it. They fought against it. At the time of the last convention in Philadelphia, last May, the molders, meeting later in Philadelphia, asked if the Foundry Supply Association could not hold its exhibit over till the date of their meeting so that these same molders and their officers might acquaint themselves with the very latest developments in molding machinery.

Such a request arises from no sordid selfishness.

In the very names union, association and convention, as in religion, no individual end is sought. All that these names stand for is the universal good.

I do not hesitate to say that

[1]This address was delivered at the May meeting of the Pittsburg Foundrymen's Association. Mr. Mumford prefaced his remarks by stating that he had strayed from the much-traveled road and had pictured the ideal.—Editor.

[2]President of the Foundry Supply Association.

think here lies the convention idea, and that I would be glad to see it elaborated in the foundry trade so that molder and foundryman might meet and study and discuss in common interest the things that are common to both. The interests of all engaged in our foundry enterprises are absolutely identical. The molder's life, liberty and pursuit of happiness are inseparably linked with the success of his employer. The millions that have been wasted in absolutely useless strife between them would have all remained in productive industry, excepting for the wilful ignorance of each, of the other's doings.

In the derivation of the name a convention signifies a coming together.

So be it. Let the convention idea live up to the name of the convention Let there come together at the convention all men and all things that can contribute to the success of the foundry industry. In the happy meeting of all that should co-operate, and the bringing home to the intelligence of all who should and shall attend the convention, the latest information they should share in common interest of all that has been done within the year, our foundry conventions must become ideal.

A well known clergyman recently wrote me, "I have often wondered what would happen if labor movements became religious." He did not mean theological or churchy. My response to his higher thought becomes this, as the suggestion grows upon me: "Cut out the tactics of war and cut in the basic ideas of fair dealing; give no man a secret, unfair advantage and let no man seek any; substitute strength of position and strength of cause for strategy, and you will have the survival of the best, the guerdon of fair justice for the brave."

Let us look forward to the day when our conventions shall be lower courts of the supreme court of public opinion.

Let the understanding between molder and foreman and foundryman be so perfect as to the latest and best methods of making castings, that no subtle, selfish, one-sided plan can ever get a start.

PERSONAL.

A. C. Willard, formerly associated with the Hill Clutch Co., and the Berkshire Mfg. Co., Cleveland, has been appointed foreman of the foundry of the Capitol Foundry Co., Hartford, Conn.

H. F. Frohman, general manager of the S. Obermayer Co., Cincinnati, manufacturer of foundry supplies, has contributed an article entitled "A Composite Guiding Star," to the May issue of *System*. In this article he expresses his belief that success in almost any vocation, if one has the energy and capacity for the task, may be derived from studying the achievements of successful men.

At a recent joint meeting of the Trade Press Association and the Space Club, of Chicago, Charles S. Redfield, advertising manager of the Yale & Towne Mfg. Co., New York, read a very interesting paper entitled "How the Advertising Manager Looks at It." He directed attention to the value of trade papers as advertising mediums and stated that the manufacturers who overlook their trade paper are deliberately handicapping themselves on the road to success.

A. Tropenas, president of the Tropenas Steel Casting Co., New Castle, Del., recently arrived in this country. He has recently taken out patents on a new steel making process, the converters of which will have a capacity of ½-ton, and it is claimed that even while working with this small quantity no difficulty is experienced in keeping the steel hot enough for pouring light work.

H. P. Parrock, formerly superintendent of the steel foundry of the Youngstown Foundry & Machine Co., Youngstown, O., has been appointed chief consulting engineer of the W. B. Hough Engineering Co., Chicago.

TRADE NOTES.

The Northern Engineering Works, Detroit, has recently installed a No. 60 Newten cupola in the plant of the Massillon Foundry & Machine Co., Massillon, O., and a No. 54 Newten cupola was installed in the foundry of the Standard Clutch Co. This concern has also installed a 5-ton 3-motor electric steel derrick, having a 75-foot radius and a 60-foot lift, in the plant of the St. Louis Basket & Box Co., St. Louis. The derrick is of the high-speed type and hoists at a speed of 60 to 75 feet per minute. The derrick is located on the river bank and conveys material from the river to the lumber yard of the box manufacturer.

Walter B. Snow, publicity engineer, has recently increased his facilities by removal to larger quarters at 170 Summer street, Boston, and the establishment of an addressing and mailing department in connection with which select mailing lists will be maintained for the special use of his clients.

The Electric Controller & Supply Co., Cleveland, announces the removal of its New York office from 120 Liberty street to the Fulton building, Hudson Terminal, 50 Church street.

The New York branch office of the Standard Gage Mfg. Co., Syracuse, N. Y., manufacturer of indicating gages, has been removed from 141 Broadway to room 1770, Hudson Terminal buildings. This change was made to secure more spacious quarters for the display of engineering specialties. The western branch of this concern is located in the Monadnock building, Chicago.

The Cleveland Steel Cement Co., Room 406 O'Brien building, Cleveland, has been organized to engage in the manufacture of "Noxall" steel cement, which is used for filling and smoothing surface imperfections in iron and steel castings. This cement is shipped in cartons containing 10, 25, 50 or 100 pounds. Samples containing about six ounces will be sent on request.

The May number of *Graphite*, published by the Joseph Dixon Crucible Co., Jersey City, N. J., contains the first of a series of articles on "The Prevention of Corrosion of Steam Machinery," by W. H. Wakeman. It likewise contains a very interesting article entitled "Crucible Economy."

The Metallic Alloys Co., 101 John street, New York, has begun the operation of its new plant at Elkton, Va., which will have a daily capacity of 30 tons of ground ferro-manganese, ferro-silicon and manganese oxide.

The J. D. Smith Foundry Supply Co., Cleveland, manufacturer of foundry supplies, has been reorganized by the election of F. A. Coleman, formerly vice president, to the presidency to succeed F. H. Chamberlin, deceased. E. S. Gaylord has been elected vice president and J. S. Smith, secretary and treasurer.

The Northern Engineering Works, Detroit, has installed a 6-ton Newten cupola in the No. 2 plant of the Goulds Mfg. Co, Seneca Falls, N. Y. A similar cupola has been shipped to the Raquette Foundry & Supply Co., Pottsdam, N. Y.

A CHILL FOR CHILLED ROLLS.

By W. J. Keep

Question:—How thick would a chill have to be to give a roll a chill depth of from 2 to 2½ inches, charcoal iron being used?

Answer:—From 4 to 6 inches thick.

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Practical articles pertaining to the trade in all its branches are solicited, and will be paid for.

When sending articles be sure to place your name and address on the article and on the drawings.

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CONTENTS.

Latter-Day Radiator Practice..... 155
Errors in the Design of Patterns... 160
Classification of Patterns..... 163
Semi-Steel Mixtures and Methods of Calculating the Charges..... 166
Molding a Steam Crane Cylinder... 168
A Memorandum on Test Bars..... 169
Production of Malleable Castings—V. 173
A Model Canadian Brass Plant.... 175
Bassite—A Substitute for Tin in Brass Mixtures 178
Phosphor-Bronze Rings 179
Spacing and Mounting Patterns.... 180
Australian Notes 183
Iron for Packing Rings..... 185
Crooked Cutting Bars..... 185
Leaky Cylinders 186
Use of Cast Iron Borings..... 186
Steel in Brake Shoe Scrap..... 186
Chilled Rolls 187
Sandwiched Hard Spots 188
Recovering Grinding Dust..... 188
Novel Air and Annealing Furnaces.. 189
Coal Consumption of Air Furnaces. 191
Malleable Castings Annealed in Scale and Charcoal 192
Problems Involved in the Erection and Equipment of a Modern Foundry 193
Three Pioneers of the Canadian Stove Trade 196
Preparations for the Toronto Convention 197
The Foundry Convention Idea..... 200
Rock-Over and Automatic Molding Machines 203
The Baillot Cupola..... 205
New Electric Chain Block Hoist.... 206
The Cleveland Squeezer..... 207
Danic Sand Blast..... 207
Core Car 208
Flexible Industrial Railway..... 208
Cleveland Tumbling Barrels..... 208
Woodison Crucible Oil Furnace..... 209
Portable Heaters 209

Tool Builders on Foundry Work

The minority report of the committee on foundry work presented at the recent meeting of the Machine Tool Builders' Association is a severe arraignment of the jobbing foundryman. It questions his business ability, criticizes his operating methods and contains a suggestion for an official protest from the organization. A list of 33 questions were submitted to the members, 60 replies having been received. Of this number, 11 own their own foundries and the report states that "It is very gratifying to know that people owning their own foundry are free from trouble." It is likewise gratifying to the foundrymen to learn that these tool builders have solved the problem of operating their casting plants without difficulties, and their methods will undoubtedly prove a revelation to the foundry trade. The majority report, however, dealt more leniently and charitably with the foundryman and concludes with the statement, that if all of the conditions indicated by the 33 questions were fully complied with from the buyers' standpoint, the foundryman would either have to go out of business or raise his prices. The gist of the report which directs attention to some of the lax methods of the tool builders in their business relations with the foundries, follows:

> It goes without saying that anyone who has had any business at all with the foundries, or has been connected with them directly, knows that many elements, many conditions, many complications, arise in the daily practice that are difficult to analyze and subject to results over which the foundryman has no immediate control.
>
> It is a well-known business fact that the average foundry has not been the financial success that perhaps other businesses are. Largely owing to the fact of the low prices prevailing, the usual buyer of castings seeks absolutely the lowest market, and then expects the best results and the best goods. Such is not the case where fair prices are given for the goods, and when fair prices are given the buyer usually can demand the high excellence that our worthy chairman expects.
>
> We think it no more than fair and proper that the buyer should visit the foundry, and furnish blue-prints for castings, and even follow same day by day, in case there should be the slightest possibility of a doubt on the part of the foundryman to understand the same.
>
> Do not forget that you should not expect the foundryman to know all the details at sight of the castings that you **may want,** and on which you have yourselves given many hours of thought, from the designing down to the finished pattern.
>
> We believe that no foundryman can afford to pay for labor on castings, that at first examination appear good, but on machining develop defects, unless the initial contract price is sufficient to prohibit the foundryman from objecting to allow such charges to be entered against him.
>
> How many buyers of castings in our association do not send formal orders with their patterns?
>
> How many patterns are frequently sent without numbering, and is it not possible that there is a lax system in vogue, in the ordering of castings, that make it a burdensome problem for the foundryman to keep track of said patterns?
>
> The foundryman pays spot cash for his material and labor. Do we always pay our foundry bills promptly, absolutely according to contract? This report is merely to draw your attention to the golden rule of "give and take," believing that the average foundryman is ready at all times not to constantly quibble and quarrel with his customers, but is ready at all times to do the fair thing.
>
> Have we not all found him accommodating many times? Have we not frequently sent patterns late in the afternoon with the request to have same put in immediately, for tomorrow's use? Have we not cancelled orders for many of the pieces, after they were made? Have we not asked for castings, which on examination and research, found had never been formally ordered?
>
> Have we not been requested many times to alter patterns, that would facilitate better results, or quicker operations, and not granted them?
>
> In other words, and finally, are there not two sides to the question?

The Toronto Meeting

The large number of new members enrolled by the American Foundrymen's Association and allied organizations during the last few months, reflects the interest that is being manifested in the June convention at Toronto, and foreshadows a record-breaking attendance. Many foundrymen will be accompanied by their heads of departments while others are planning to send a number of their molders and apprentices. The papers that will be presented at the meetings of the American and Brass Foundrymen's Associations are of unusual value and several practical topics have been assigned for discussion. No less than 60 concerns have reserved space in the Process building and Machinery Hall and practical demonstrations will be made of all kinds of foundry equipment. Several new types of molding machines will be shown for the first time, while the cupola which will furnish the iron will prove a revelation to many foundrymen. While it has been practically decided to hold the next convention in Cincinnati, both Pittsburg and Detroit foundrymen are anxious for the gathering in 1910. At the Toronto meeting, added impetus will undoubtedly be given the movement to raise a fund to enable the American Foundrymen's Association to conduct experiments and investigations, the cost of which in the past has been almost entirely borne by the individuals themselves, who contributed their efforts for the good of the cause.

FOUNDRY & PATTERN SHOP EQUIPMENT

Rock-Over and Automatic Molding Machines—Baillot Cupola—Chain Block Hoist—Squeezer—Sand Blast—Tumbling Barrels—Crucible Oil Furnace

THE ARCADE Mfg. Co., Freeport, Ill., has added a number of new types to its extensive line of molding machines, including two styles of rock-over machines, an addition to its line of "modern" machines and a large automatic molding machine.

For several years this concern has been experimenting in its own foundry with a rock-over machine that will handle a wide range of work with speed and accuracy and one that will be simple enough in design to be easily operated by the average laborer. Fig. 2 shows the Arcade rock-over with the drag half of a pattern plate mounted on the table. The flask is in position to receive the sand. At the left of this illustration are shown two parallel bars which serve as rests for the mold when it is rolled over, as shown in Fig. 1, and these form a part of the adjustable leveling device which insures an accurate bearing for the bottom board. Figs. 1 and 2 show a machine built for a job requiring a 12-inch lift, but special machines of this design may be made to handle much deeper patterns. The method of drawing the patterns is one of the interesting features of this machine. While the pattern is being drawn the table holding the pattern plate is moved upward and the rest holding the mold is lowered at the same time.

The pattern may be vibrated by compressed air or hand. The table is counterbalanced by heavy springs and large molds can be easily and rapidly handled. In Fig. 1, a machine for making the cope part of the mold is shown. The lever operates the pins which press against the ears on the flask and assist in starting the mold.

Smaller Rock-Over Machine.

Figs. 3 and 4 show the Arcade rock-over No. 1 molding machine in two positions. This is a smaller machine than the one described, and is used for work requiring a lift of 6 inches or less. In this view the set of match plates mounted are used in making the heavy cast iron car wheels used on the molding machines made by this concern. Fig. 4 shows the match plates in position before the flasks are in place. In Fig. 3 the position of the pattern plate is shown after it has been drawn from the sand.

The last addition to the line of "Modern" molding machines made by this concern is known as the "Modern No. 3." A feature of this machine is the double table on which may be mounted two different sets of pattern plates, or the cope and drag sections of a single pattern of large dimensions, shown mounted on the machine in Figs. 5 and 6. The flask used is 34 x 12 inches. These machines are operated by two men, as the molds and the flask are too large to be easily handled by one operator. For pressing the mold and drawing the pattern each operator uses a lever. The pattern may be vibrated by hand but compressed air is recommended. In Fig. 5 the sliding table has been run forward and the drag half of the flask is shown with a casting placed to indicate the position. The cope

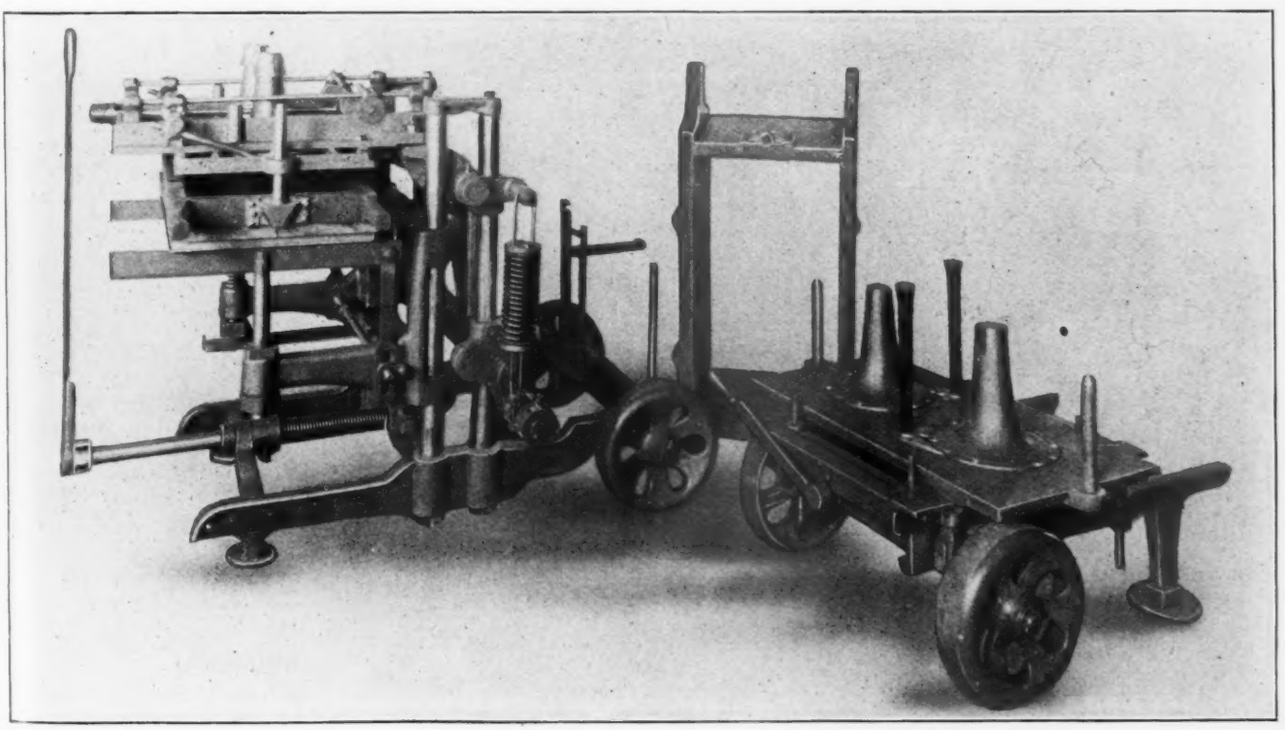


FIG. 1—ROCK-OVER MACHINE FOR MAKING COPE PART OF MOLD

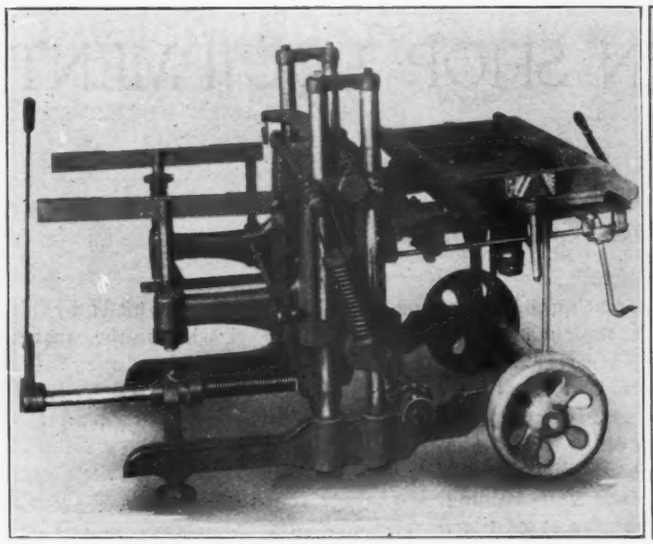


FIG. 2—ROCK-OVER MOLDING MACHINE WITH DRAG HALF OF PATTERN PLATE MOUNTED ON THE TABLE

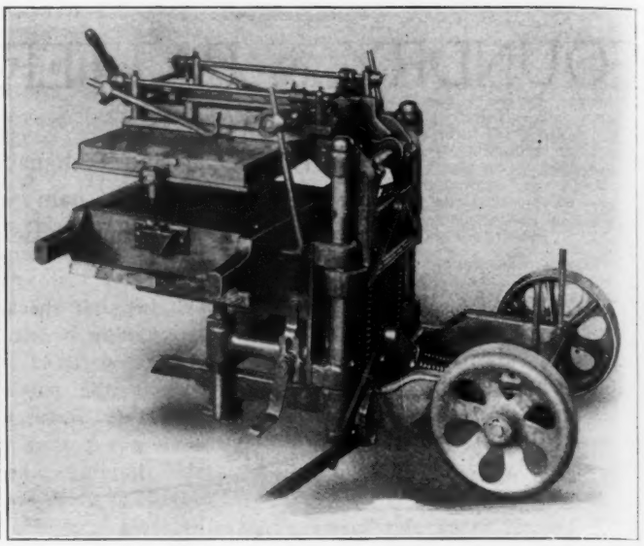


FIG. 3—ROCK-OVER NO. 1, SHOWING POSITION OF THE PATTERN DRAWN FROM THE SAND

halves of the plate and flasks are shown in place ready to receive the same. In Fig. 6 the revolving table is tilted to show the cope half of the pattern plate. A large amount of work can be readily produced on this machine which is now being rammed by hand on the floor.

Automatic Machine.

The new automatic molding machine is shown in Fig. 7. The sand is carried from the floor by means of a conveyor to a rotary riddle and from this it is carried by a belt conveyor to a hopper of large capacity. When operating the machine, the flasks are placed as shown in Fig. 1 and a device for striking off the sand actuated by a lever is run into position over the flasks as shown in Fig. 9. By means of another lever the sand is dropped from the hopper into the flask with sufficient force to thoroughly tuck it around the patterns. In order to thoroughly tuck the sand around the patterns two vibrators are provided. After vibrating, the strike-off automatically returns to its former position, the bottom and cope boards are adjusted, being firmly held in position by automatic clamps. The table is then rolled over and the ramming operation is begun. When the proper pressure has been exerted the clamps that hold the cope and bottom boards automatically release, and the double vibrator is operated while the patterns are drawn from the sand, as shown in Fig. 8.

While the first set of patterns are being pressed, the operator places another set of flasks in position on another set of plates on the upper side of the table, so that while the first patterns are being drawn, the sand is being tucked around the second set of patterns. When the table has resumed its first position, the first

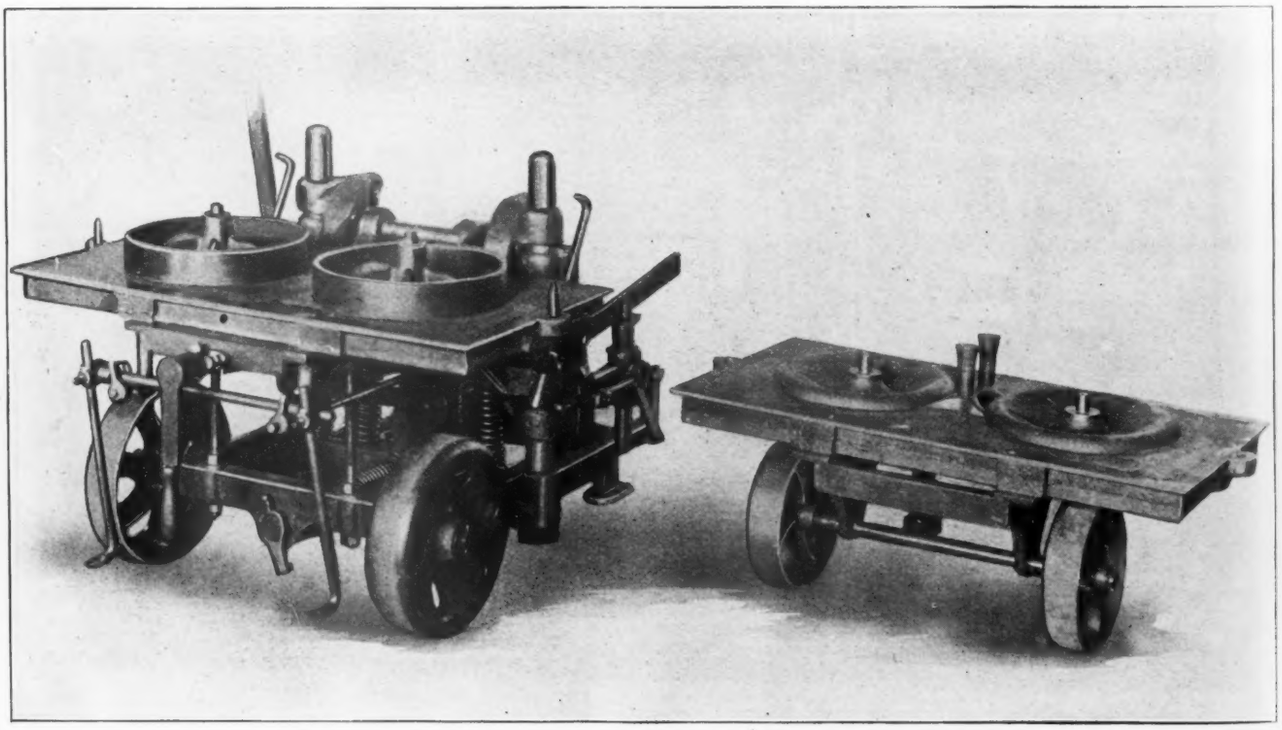


FIG. 4—MOLDING MACHINE NO. 1, SHOWING MATCH PLATES IN POSITION BEFORE THE FLASKS ARE IN PLACE

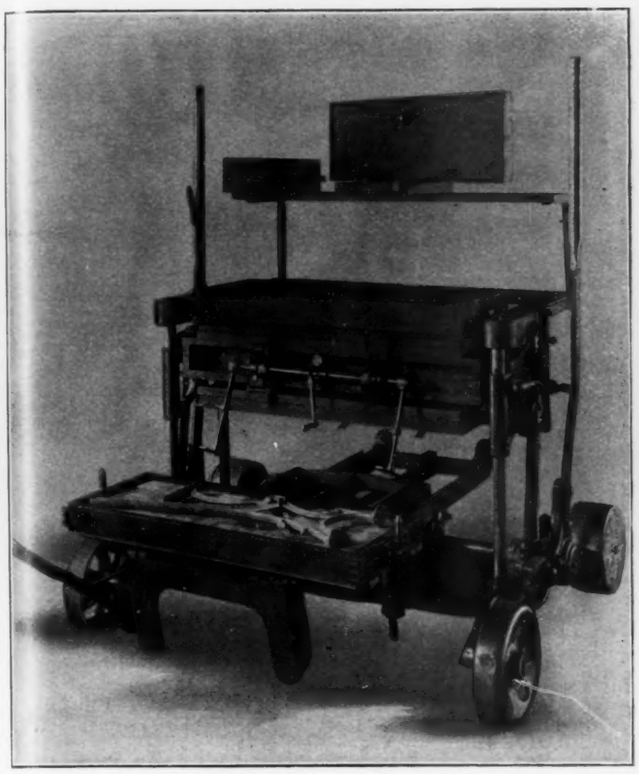


FIG. 5—"MODERN" MOLDING MACHINE, NO. 3, SHOWING THE SLIDING TABLE RUN FORWARD

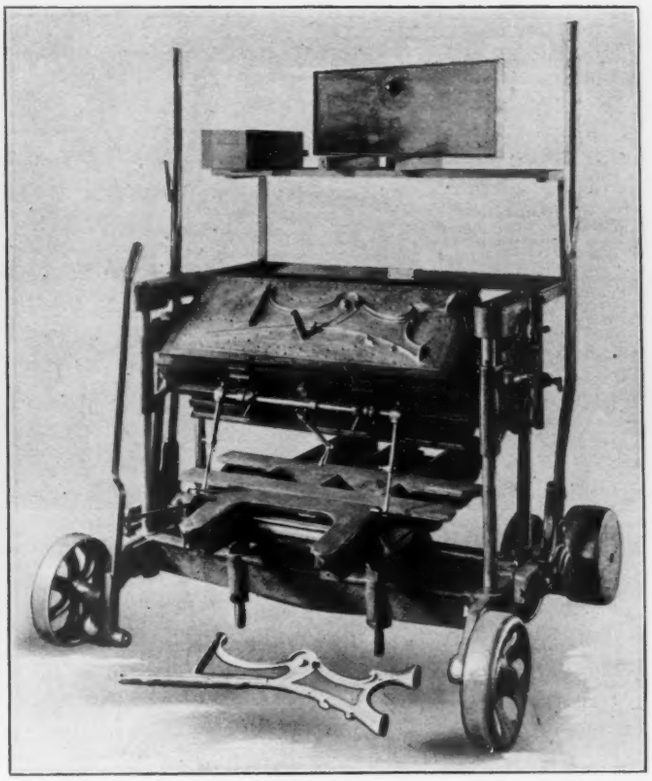


FIG. 6—REVOLVING TABLE TILTED TO SHOW THE COPE HALF OF THE PATTERN PLATE

mold is run forward on the carriage as shown in Fig. 9. Here it is closed by a helper and carried away.

All of these operations can be accomplished rapidly, the operator merely moving the levers shown in Fig. 10, and places the flasks and boards in position, the machine doing the rest.

Among the many new features embodied in this machine is the use of two sets of pattern plates not necessarily of the same pattern, on one machine. Patterns of a lamp bracket are shown mounted in Figs. 7, 8, 9 and 10. On one side of the table the pattern plates for the arm of the bracket are mounted and on the other side the wall plate of the bracket is shown. The machine is simple in design considering its automatic features, and the molds that are produced are perfect in every way.

THE BAILLOT CUPOLA.

The A. Baillot cupola, which will be shown in operation at the Toronto convention of the American Foundrymen's Association by J. de Clercy, Montreal, general agent for America, embodies many interesting features. It utilizes much of the waste heat of the furnace, as part of the gases escaping through the top of the cupola are drawn into and mixed with the air that is blown into the cupola. Mixed with the air blown in at the tuyeres, the gases prevent the congealing of the drops of molten iron passing the mouth of the tuyeres. The carbon monoxide returned to the base of the cupola constitutes a complement of fuel, adding its own carbon to that of the coke already consumed. In an ordinary cupola the proportion of car-

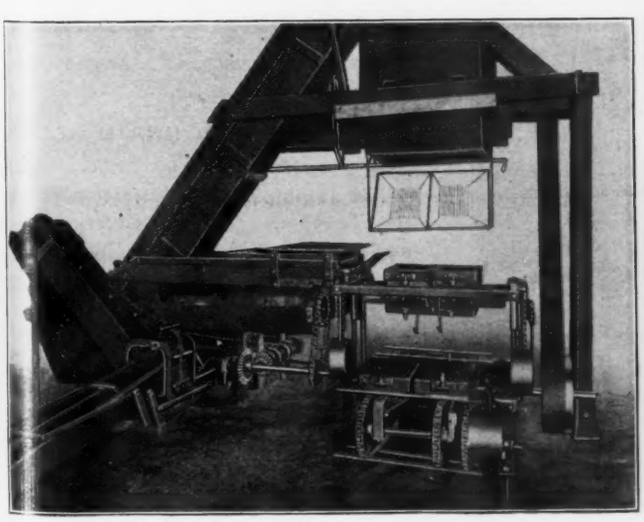


FIG. 7—AUTOMATIC MOLDING MACHINE, SAND CONVEYOR AND HOPPER

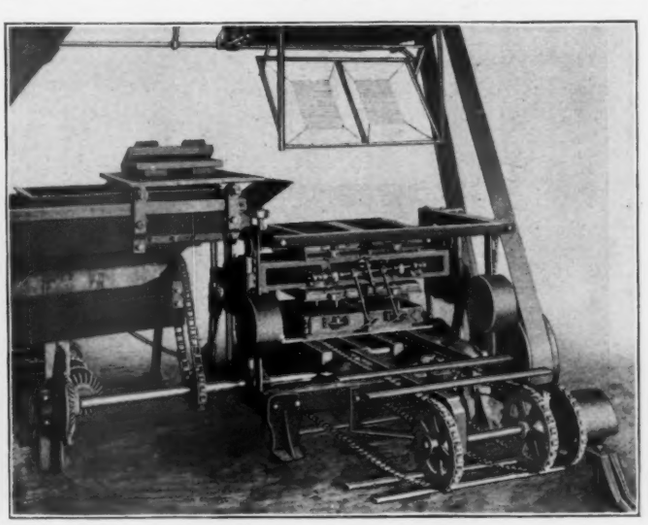


FIG. 8—PATTERN DRAWN FROM THE SAND

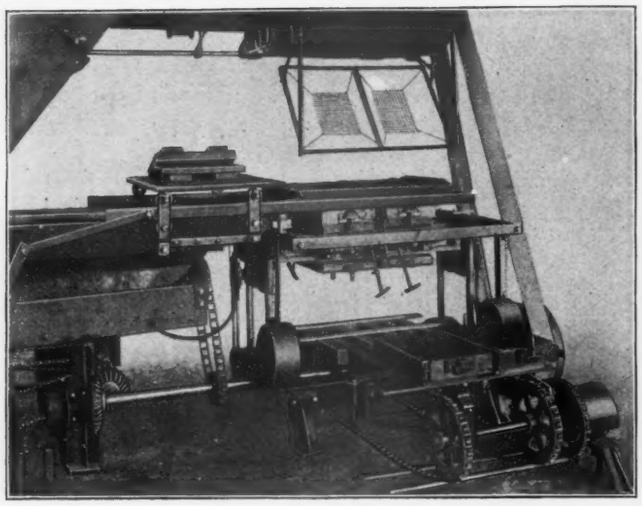


FIG. 9—STRIKE-OFF IN POSITION OVER THE FLASKS AND MOLDS RUN FORWARD ON THE CARRIAGE

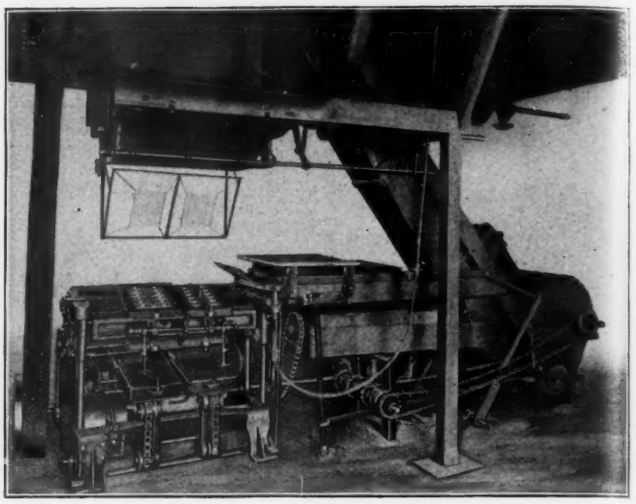
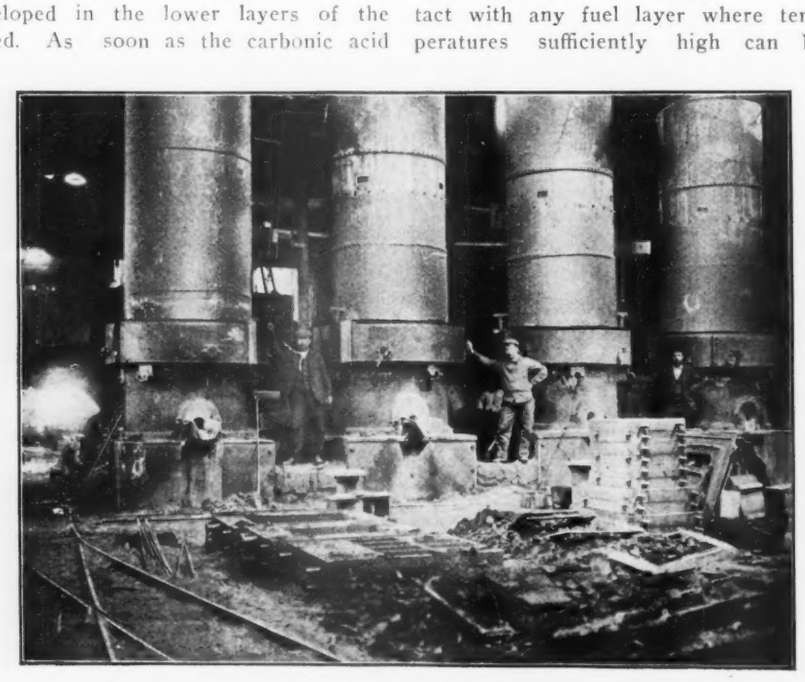


FIG. 10—ANOTHER VIEW OF THE AUTOMATIC MOLDING MACHINE

bon monoxide is double that of the carbonic acid, which means that about two-thirds of the carbon consumed in the cupola is to be found in the carbon monoxide given off by it. If all of this gas could be utilized its combustion would effect an actual saving of about 22 per cent of the fuel consumed. While the Baillot process does not save all of this heat, nevertheless that proportion of it which is actually saved is far from being a neglible quantity. The carbonic acid gas and steam from the burned gases mixed with the air have an important action on the process. They raise the temperatures of the upper layers of the bed of coke to a considerable extent at its point of contact with the solid metal, which is done at the expense of excessive temperatures developed in the lower layers of the bed. As soon as the carbonic acid meets the layer of fuel where the temperature is excessively high, it is dissociated at the expense of the heat developed in this zone, and is thus reduced to carbon monoxide. The carbon monoxide thus formed, ascends to the upper part of the bed of coke, where it is burned and is once more transformed into carbonic acid and steam, provided it meets at this point a quantity of oxygen sufficient to effect its complete combustion.

In burning anew in the upper part of the bed of coke it releases and makes available all the heat it had taken up for its formation at a point in direct contact with the layers of iron, where it will do the most good. The iron melts and runs through the coke bed gradually, acquiring additional heat without coming into contact with any fuel layer where temperatures sufficiently high can be found to burn it, or where it can meet with any current of air that is liable to oxidize or congeal it.

The position of the tuyeres varies with the nature and quality of the fuel used. Several rows of tuyeres are generally installed. Another advantage of this cupola is that no flames appear at the top of the stack. Reservoirs, or what are styled as front crucibles, are used, and have several advantages. The practice of allowing a deep bed of molten iron to accumulate at the bottom of the cupola is usually injurious to the castings, inasmuch as the iron has a tendency to absorb sulphur. By the use of this reservoir, the iron does not remain in the cupola after it has been melted. This results in a more homogeneous iron, as this crucible also acts as a mixer. When making castings of a required weight, the exact amounts of iron needed can be run into the crucible, and for making special mixtures alloys can be added. The accompanying illustration shows a battery of four Baillot cupolas.



A BATTERY OF FOUR, A. BAILLOT CUPOLAS

A NEW ELECTRIC CHAIN BLOCK HOIST.

The accompanying illustration shows the Northern C type electric hoist made by the Northern Engineering Works, Detroit. This hoist is designed to supplant the ordinary chain block suspended by a single hook and is of the same general design as the usual hand chain block, excepting that it is driven by a crane motor with a standard crane controller containing ample resistance. The hoist can be operated at fast or slow speed, as desired. A speed ten times greater than that obtained by hand operation is available. In relative size, a hoist

of a given capacity is about double the size and strength of a similar hoist operated by hand. The necessity of this large factor of safety is due to the more severe service encountered by a hoist using electric power.

The hoist is suspended from a sin-

NORTHERN, TYPE C, ELECTRIC HOIST

gle hook, which has an advantage as compared with the ordinary drum hoist. It is impossible to throw the sprocket chain out of the sprocket by tipping the hoist or allowing it to get out of line. The hoist can also be swung off sidewise without difficulty.

The gears used are cut spur gears. The principal gears are accessibly enclosed for an oil bath. The hoist is provided with an automatic disc type of brake and uses a standard crane motor, wound for direct or alternating current. The controllers give a wide range of control and five or six speed steps.

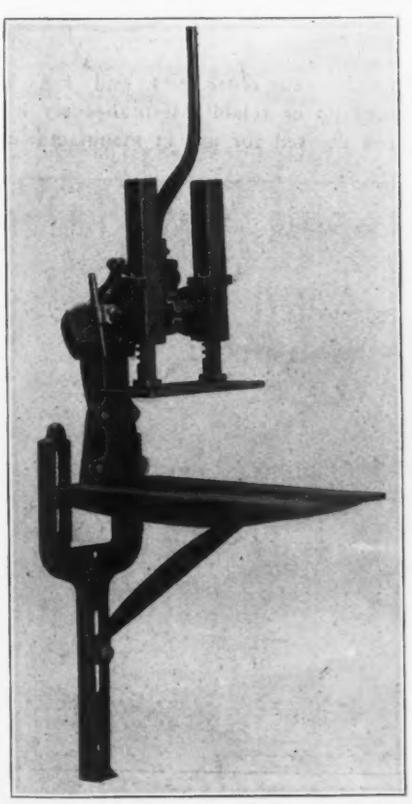
The hoist is recommended for moderate service, and is especially suitable for use in boiler and machine shops over tools and for certain classes of foundry service. It has been used with success over the molding floors of several foundries. The present design is a modification of the original C type hoist placed on the market three years ago. It has, however, been rearranged to secure a shorter space between hooks providing for higher lifts under low ceilings. It is made in six sizes ranging in height of lift from 8 to 12 feet and requiring a 1½ and 5-horsepower motor in the smallest and largest size, respectively. The capacity of the smallest hoist is one ton and that of the largest six. These hoists weigh 650 and 1,100 pounds, respectively.

THE CLEVELAND SQUEEZER.

The Cleveland molding machine has been designed especially for use in foundries where a clean floor is desired without obstructions underneath the machine. It can be adjusted to the proper operating height required by any molder and may be used either for squeezing or for ramming up flasks on the skids which project beyond the presser head. The lever used for squeezing is at the top of the machine and by means of gears, operates two vertical racks connected to the presser head insuring a uniform pressure on the mold. A lever at the side of the machine shown in the accompanying illustration, which engages a dog or catch insures practically an instantaneous adjustment to the height of the flask. A vibrator can be atached directly to the machine, the vibrator being operated by a knee valve. The squeezer is built by the J. D. Smith Foundry Supply Co., Cleveland.

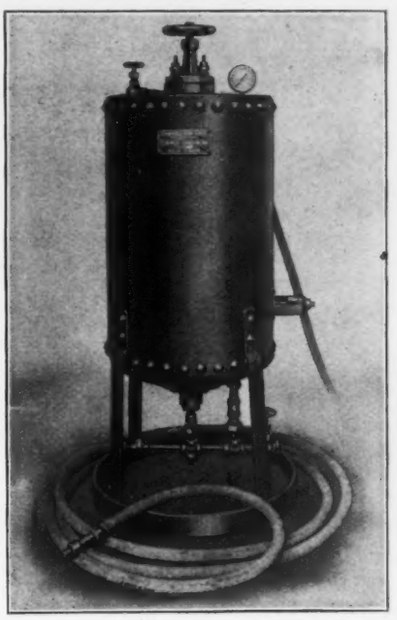
THE DANIC SAND BLAST.

The accompanying illustration shows the new Danic sand blast, for which the manufacturers point out a number of superior features. It is a combination



THE CLEVELAND MOLDING MACHINE

high and low pressure machine, permitting of easy and speedy regulation throughout its range of from 20 to 90 pounds of air, according to the character of work to be cleaned. An improved throttling valve controls both the working pressure (air) and the sand supply, while a new style of valve and sand feed eliminates any chance



THE DANIC SAND BLAST

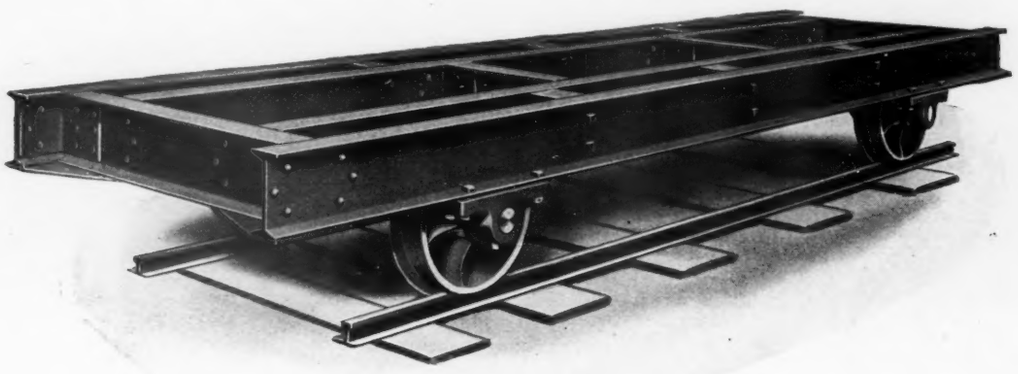
of the sand clogging because of foreign substance it may contain. An automatic separator has been developed to remove any moisture from the compressed air coming in contact with the sand.

These sand blasts are made in nine sizes, ranging in sand capacity from 400 to 2,200 pounds, and special types and sizes are built to order. The nozzle is of special design, made from crucible and high grade tool steel, thereby giving unusual durability and other superior results. Batcheller, Clarke & Batcheller, Inc., 90 West street, are exclusive sales agents for the east and central west.

"Accidents, Their Causes and Remedies," is the subject of a treatise, written by Thomas D. West, on the development of care and faithfulness on the part of workmen to aid the safeguarding of life and property. For several years the author has been agitating the need of developing greater care and faithfulness among experienced employes. He has hopes that the suggestions contained in this book will bring to the masses a realization that the greatest safeguard against casualties, aside from safety devices, is the development of precautious natures in boys and girls.

MOLD DRYING, ANNEALING AND CORE CAR.

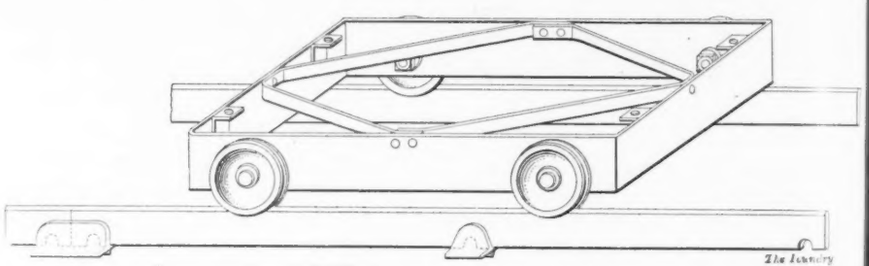
The accompanying illustration shows a mold drying, annealing oven and core car of new design and construction manufactured by the Chase Foundry & Mfg. Co., Columbus. One of the principal features of this car are the two parallel beams close to the wheel which are connected to the axle by heavy brackets or boxes and provide a support on both sides of the wheel. The wheels revolve on the axle and are supplied with roller bearings. With this construction the capacity of the car is greatly increased and the fact that it is impossible to spring the axle or force the wheels and bearings out of alignment insures a free and easy operation of the car. These cars are made in various sizes with open frame platforms or with platforms covered with steel plate as well as with portable decks for handling various sizes of cores.



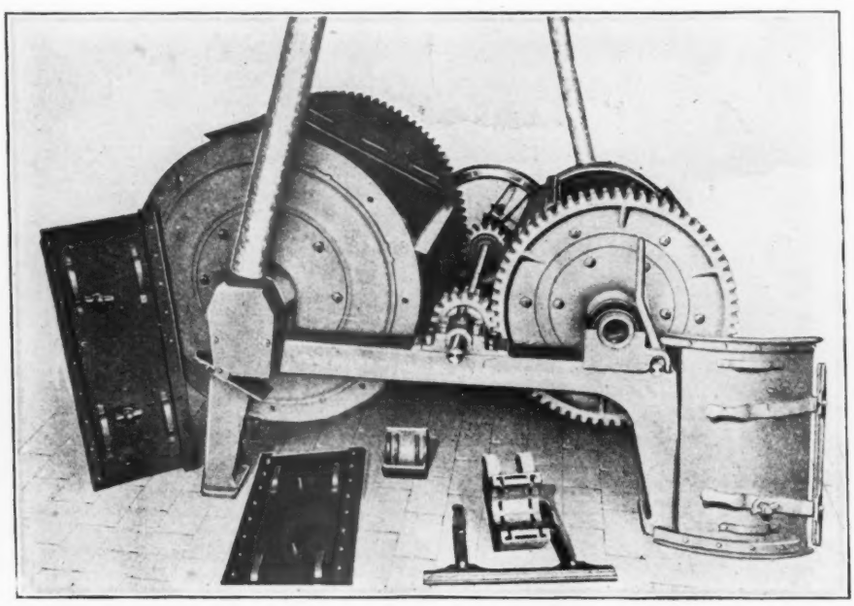
MOLD DRYING, ANNEALING AND CORE CAR

A FLEXIBLE INDUSTRIAL RAILWAY FOR THE FOUNDRY.

An industrial railway system which requires no cross ties and can be taken up or relaid instantaneously has been devised for use in manufacturing plants and is admirably adapted for foundries in which the floor is reasonably firm and level. In place of rails which are ordinarily spiked to cross ties, this system employs round edge steel strips, ½ inch thick and 3 inches high, in sections 16 feet long. These are supported on edge by cast shoes located at convenient intervals and remain constantly in their position. The fact that these shoes are slotted to a considerable depth insures absolute rigidity to the rail, which is prevented from slipping by a notch in the under side, fitting accurately over a corresponding raise in the bottom of the shoe slot. A double shoe of this type holds the rails together at juncture points. This railway is built by the G. & W. Mfg. Co., 26 Cortlandt street, New York, which has also designed an all-metal industrial car possessing some novel features. This car is constructed entirely of steel, as shown in the accompanying illustration, the frame being welded into a continuous strip, made rigid by lighter strips bolted at the top of the frame in such manner as to support any sort of platform desired. These cars are equipped with roller bearing wheels with double flanges fitting over the rails. This method of construction gives the car a low cost and possesses other evident advantages, among them the doing away



INDUSTRIAL RAILWAY FOR FOUNDRY USE



CLEVELAND TUMBLING BARRELS

with expensive switches. The entire system, when not in use, can be taken up and stored in small space.

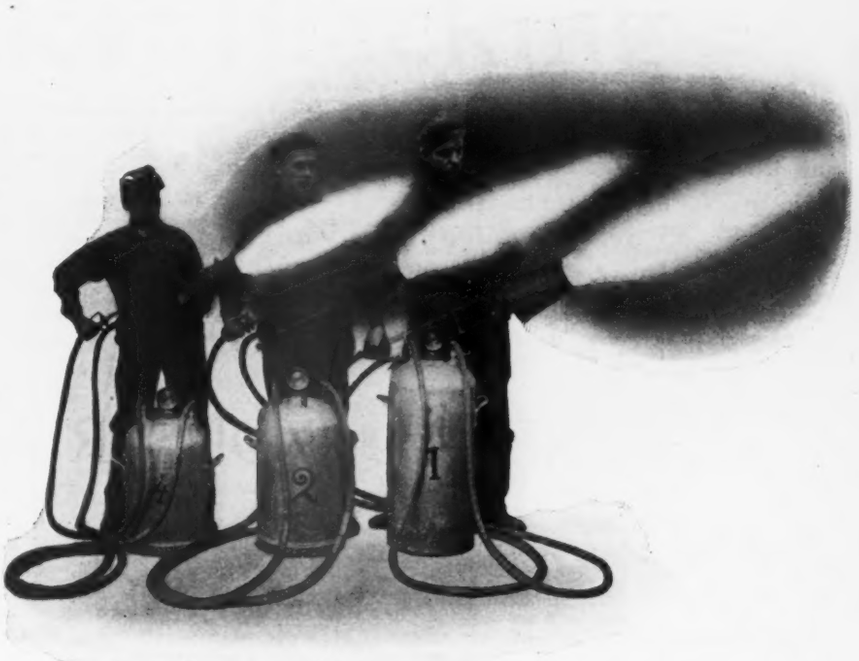
CLEVELAND TUMBLING BARRELS.

The tumbling barrels shown in the accompanying illustration built by the Cleveland Tumbling Barrel & Mfg. Co., Cleveland, are made of ½-inch steel plate and are provided with an exhaust arrangement. The square barrel shown is 34 x 34 inches and 40 inches long, while the round barrel is 30 inches in diameter and 40 inches long. The bearing shown in the foreground of the illustration is fitted up with lignum-vitae, dovetailed into the casting, which makes a very durable bearing. An oil channel and oil rings provide a bath of oil for the bearing which is covered by a cap excluding the dust and sand of the cleaning room. These mills are built to order in any size or style as desired. At the foundrymen's convention, Toronto, these mills will be exhibited by the J. S. McCormick Co., Pittsburg.

THE WOODISON CRUCIBLE OIL FURNACE.

The crucible metal melting oil furnace shown in the accompanying illustration has made some remarkable records in low fuel consumption. It has been shown by actual tests that brass and bronze can be melted at 7⅛ cents per hundred pounds, estimating the cost of the fuel oil at 4 cents a gallon. Heats have also been made with a No. 70 crucible in 55 minutes. By the use of this furnace no metal can be lost and in case of a spill the metal drops to the bottom of the furnace where it can be secured when the bottom is dropped. Very little noise is made by the blast and neither fumes nor gases can escape. This furnace is manufactured by the Detroit Foundry Supply Co., Detroit.

Woodison Crucible Oil Furnace



Portable Heaters Built by the Hauck Mfg. Co.

PORTABLE HEATERS.

The accompanying illustration shows three different sizes of portable heaters in operation, which are manufactured by the Hauck Mfg. Co., Brooklyn, N. Y. These burners are so constructed that they insure a complete combustion of fuel and, therefore, there is no smoke and no oil is wasted. For skin drying molds and heating ladles, maximum temperatures are not required. These burners are so constructed that the degree of heat can be regulated to meet all requirements. These burners can provide a sufficient degree of heat to melt the softer metals and can be used for heating and burning on castings, brazing, firing cupolas, etc.

The Goldschmidt Thermit Co., New York, has established an office and works at 103 Richmond street, Toronto, Canada. The new branch was opened for business May 1, and is under the management of E. C. Rutherford, who, for several years, was manager of the Magann Air Brake Co., and of the Canadian Brake & Supply Co. A complete stock of thermit and appliances will be carried in Toronto, and the branch organization will be equipped to promptly execute orders for the welding of heavy steel sections, such as sternposts of steamships, crank shafts, trolley rails in paved streets, motor cases, and other broken steel sections. A fully equipped shop will be maintained for the repair of steel castings ranging in weight to 1,000 pounds.

TRADE PUBLICATIONS.

ENGINES.—The American Blower Co., Detroit. Catalog No. 232, which supersedes No. 206. It is devoted to a description of vertical self-oiling engines made by this concern. Several pages are also devoted to a description of volume blowers for furnishing the blast for forges, cupolas and wherever a large volume of air at moderate pressure is desired.

DUST COLLECTORS.—The Knickerbocker Co., Jackson, Mich., has issued a handsomely illustrated booklet which describes a new type of collector that operates on the vacuum principle. The collector is located between the source of dust supply and the fan, so that the fan draws air through the collector and maintains a constant vacuum tendency in the collector casing. By this arrangement a practically perfect separation of the material from the air is secured and the dust product is removed from the air current before the air reaches the fan.

GAS ENGINES.—The Bruce-Meriam-Abbott Co., Cleveland, in section 1 of catalog A, describes its vertical gas engines for electric lighting, pumping and general power purposes.

CHAIN HOIST.—The Northern Engineering Works, Detroit, has issued a 4-page folder describing the Northern C-type, electric portable chain hoist, overhead trolleys, tracks, switches, etc., and type-C one and two-motor electric hoists.

SMOOTH-ON.—The Smooth-On Mfg. Co., Jersey City, N. J., has published a 4-page folder describing Smooth-On gaskets and a number of testimonial letters from satisfied users are included.

INDUSTRIAL LAW LEAGUE.—The Industrial Law League, Inc., 170 Broadway, New York, has published a 12-page booklet setting forth its plan and scope. This concern is especially engaged with legal causes involving the technique. Through a corps of legal specialists comprising its law department it will institute proceedings directly or as associates for out of town or foreign interests and is available at short notice for examining witnesses, preferably in or about New York, particularly in patent interference and infringement suits. A chain of associates throughout Continental Europe, Great Britain, South America and Canada also enables this concern to investigate and prosecute foreign interests. Its patent department has facilities for soliciting United States and foreign patents, trade marks, designs, copyrights, etc.

PYROMETERS.—The Bristol Co., New York, in bulletin No. 29 describes a combination indicating and recording unit electric pyrometer which can be used to advantage on blast, annealing and hardening furnaces, galvanizing plants and heat treatment furnaces.

ELECTRICAL CRANE FITTINGS.—Bulletin No. 281, published by the Electric Controller & Supply Co., Cleveland, bound in loose-leaf form and containing 24 pages, is devoted to a description of crane fittings, knife switches, circuit breakers, rosettes, crane switchboards, cast grid resistance, coil resistance, limit stops, universal insulator supports, flexible couplings, etc.

SAND.—The Interstate Sand Co., Cleveland, miner and shipper of high grade molding sands, has published a new 4-page folder, which contains ten commandments for the business world. The tenth commandment provides that "Thou shalt give every man a square deal. This is the last and great commandment, and there is no other like unto it. Upon this commandment dependeth all the law and the profits of the business world."

MOTORS.—The Lincoln Motor Works Co., Cleveland, in bulletin No. 10, describes the merits of some of the various applications of its type A, variable speed motor.

ELECTRIC FANS.—The Sprague Electric Co., New York. 32 pages. Catalog devoted to a description of electric fans for various uses.

GENERAL INDUSTRIAL NOTES

The American Blower Co., Detroit, has purchased the foundry formerly operated by the Northwestern Foundry & Supply Co., Detroit, manufacturer of cast iron soil pipe and fittings. This foundry will be devoted to the production of castings for blowers, exhaust fans, engines, heaters, etc. Patterns of soil pipe and fittings, as well as a large stock of finished pipe fittings and plumbers' supplies, will be disposed of.

The Eagle Iron & Brass Foundry, Passaic, N. J., has recently added a machine shop to its plant. The foundry has recently been enlarged by the erection of an extension 80 x 100 feet and a cleaning department has been added 30 x 60 feet.

Contracts for the buildings, cranes, and power plant equipment for the new steel casting plant of the Tropenas Steel Co., New Castle, Del., have already been awarded, and the steel work is already well under way. It is probable that the plant will be placed in operation early in the fall.

The foundry business conducted by the Willamette Iron & Steel Works, Portland, Ore., has been purchased by the Independent Foundry Co. of that city. It will continue to manufacture iron and semi-steel castings.

The Trinidad Foundry & Machine Co., Trinidad, Colo., has added a brass melting furnace to its foundry equipment and is now in position to produce all kinds of brass castings, as well as gray iron sections. This concern manufactures mining cars of all kinds, as well as roller bearings and self-oiling car wheels.

The Kansas City Steel Castings Co., Kansas City, Mo., has built a new foundry designed especially for making small steel castings. The plant will have a capacity of 10 tons daily. The members of the new concern are F. R. Strunk, H. F. Hamacher, and G. R. Strunk.

The Summit Foundry Co., Akron, O., recently incorporated, will not erect a new plant, but has leased a foundry on Kelly avenue and Railroad street, East Akron. The company will do a general jobbing business.

The firm name of the Scott National Radiator Co., Cambridge City, Ind., has been changed to the Scott Stove & Furnace Co.

The stove plant of the Leonard Stove & Range Co., Bowling Green, O., will be sold at public auction by D. W. Pugh, trustee in bankruptcy, on June 30. The buildings are of brick construction and consist of a foundry, 54 x 126 feet; cupola room, 20 x 21 feet; cleaning room, 24 x 126 feet; mounting and nickeling room, 56 x 120 feet; engine room, 25 x 44 feet; warehouse, 72 x 145 feet; pattern storage vault, 24 x 30 feet; carpenter shop, 26 x 35 feet, and office building, 25 x 31 feet.

New Construction.

H. Brewer & Co., Tecumseh, Mich., will erect a large foundry to provide increased capacity for their growing business. The main building will contain the machine, woodworking and forge shops, office and warehouse, and will be of brick construction, 90 x 332 feet. The foundry will be erected in the rear of the main building and will be 60 x 100 feet, and the cupola and blower house will be 30 x 30 feet. The core room will be 25 feet square. A pattern shop 50 x 60 feet will be erected in the rear of the foundry. Considerable new machinery will be purchased. Davis Brown is superintendent and Charles Burridge, purchasing agent.

The Glacier Metal Co., Richmond, Va., will erect a new plant 40 x 100 feet, which will be equipped for the manufacture of anti-friction metal. The plant will have a daily capacity of about 25,000 pounds.

The American Seeding Machine Co., Springfield, O., will erect a new foundry 150 x 200 feet. Considerable new machinery will be purchased.

F. M. Mackin & Co., brass founder and finisher, Baltimore, will enlarge their foundry by the erection of an additional story 31 feet square on the building at 509 N. Spring street, and a two-story addition 18 x 31 feet in the rear of the foundry at 507 N. Spring street.

Hertzler & Zook, Belleville, Pa., iron and brass founders, have just purchased the plant of the Belleville Planing Mill Co., adjoining their works, which will be fitted up for foundry use.

The American Manganese Bronze Co., Philadelphia, will erect a brick and concrete foundry and warehouse, 70 x 120 feet.

The American Brass Mfg. Co., Cleveland, has awarded contracts for the erection of a new foundry and machine shop. The foundry will be 40 x 144 feet, and the machine shop will be two stories high, 35 x 135 feet.

The Independent Stove Co., Detroit, has commenced the erection of its new plant at Owosso, Mich. The foundry will be 72 x 150 feet and the assembling and storage room, 60 x 150 feet, two stories high. The building will be substantially built of brick and will give the company 50 per cent greater producing capacity than it now has at Detroit.

The Buckeye Steel Casting Co., Columbus, O., has awarded the contract for the erection of a new building, 20 x 40 feet, for a producer gas plant, to the Mt. Vernon Bridge Co. Plans are also being prepared for a new pattern shop.

The Atlas Brass Co. has established a brass foundry at 991 South Front street, Columbus, O., and will engage in general jobbing work. I. H. Pleukharp and John Wittman are interested in this concern.

The Crompton & Knowles Loom Works, Worcester, Mass., will erect a foundry 225 feet square. It will be devoted largely to light work and a large number of molding machines will be installed. Other additions to be made to this plant will include a main building 60 x 246 feet and a 4-story machine shop, 54 x 184 feet.

Geo. Barcus & Co., Wabash, Ind., are erecting a new foundry, 60 x 220 feet. This plant will be placed in operation about July 1. This concern makes a specialty of automobile castings.

The National Sanitary Co., recently incorporated with a capital of $200,000, has purchased 20 acres of land at Salem, O., on which it will erect a plant for the manufacture of bath tubs, lavatories and other enameled ware. The foundry will be 100 x 450 feet, and another building of the same dimensions will also be erected.

A few reasons covering the advantages to be derived by the use of our

Eureka Blacking

1st. It has no graphitic carbon whatever in its make up, and consequently does not make a hard scale on the casting; the machinist likes this.

2nd. It does not foam, and core washes or blackings which do, leave a bubble; the bubble breaks in the oven, leaving part of your core or mold not painted.

3rd. It absolutely will not rub off, and is the only blacking on the market with this advantage.

ALL AGREEMENTS ARE CONTINGENT UPON CAUSES OR DELAYS BEYOND OUR CONTROL

H. V. MOORE, PRES. AND GEN'L MGR. CHAS. MUELLER, SEC'Y AND TREAS.

THE VICTOR FOUNDRY & MFG. CO.
HAMILTON, OHIO

Light & Medium Weight
GRAY IRON CASTINGS
A Specialty

Corner Ludlow Avenue and
C. H. & D. R. R. Lindenwald

Hamilton, O., Mar. 13th, 1908.

Detroit Foundry & Supply Co.,
Detroit, Mich.

Gentlemen,-

Enclosed find our check for trial bbl. Eureka Blacking; we have just opened it and tried same and find it all right. Now, we have some old which is on hand and want to use it up and also your bbl., and then we will place our order again.

Yours respectfully,

The Victor Foundry & Mfg. Co.,

By Chas Mueller Secy & Treas

4th. As it will not rub off, it naturally follows it will not run before the metal, nor peel.

5th. It requires very little stirring to keep it in suspension.

6th. It is not necessary to use clay wash, flour or molasses water; plain water is sufficient.

7th. We will send it to you on any reasonable guarantee you wish to specify.

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Northern Engineering Works, Detroit.
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Engines (Steam):
American Blower Co., Detroit.

Engineers (Foundry, Mech., Elec., Etc.):
Carr & Speer, New York City.
Dodge & Day, Philadelphia.
Kawin Co., Chas. C., Dayton, O., and Chicago, Ill.
Lindsay, W. W. & Co., Philadelphia.
Northern Eng. Wks., Detroit, Mich.
Seaver, John W., Cleveland.
Smith Foundry Supply Co., J. D. Cleveland, O.

Exhausters (Gas):
Wilbraham-Green Blower Co., Philadelphia.

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Combined Foundry Supply Co., Buffalo, N. Y.
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Doggett, Stanley, New York.
Hill & Griffith Co., Cincinnati.
McCormick, J. S. Co., Pittsburg.
Obermayer, S. Co., Cincinnati.
Paxson, J. W. Co., Philadelphia.
Pettinos Bros., Bethlehem, Pa.
Stevens, F. B., Detroit.

Fans:
American Blower Co., Detroit.

Ferro-Manganese:
Lang, R. F., New York City.
Metallic Alloys Co., New York City.
Midvale Mining & Mfg. Co., St. Louis, Mo.
Rogers, Brown & Co., Cincinnati.
Western Foundry Supply Co., E. St. Louis, Ill., New York City.

Ferro-Silicon:
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Midvale Mining & Mfg. Co., St. Louis, Mo.
Primos Chemical Co., Primos, Pa.
Roessler & Hasslacher Chemical Co., New York.
Western Foundry Supply Co., E. St. Louis, Ill., New York City.

Fillers (Metallic):
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Cleveland Steel Cement Co., Cleveland.
Shanafelt Mfg. Co., Canton, O.
Shelton Metallic Filler Co., Derby, Conn.
Smooth-On Mfg. Co., Jersey City.

Fillets (Leather & Wood):
Shanafelt Mfg. Co., Canton, O.

Fire Brick:
Borgner Co., Cyrus, Philadelphia.
Detroit Foundry Supply Co., Detroit.
Federal Clay Products Co., Mineral City, O.
Gautier, J. H. & Co., Jersey City.
Harbison & Walker, Pittsburg.
Maurer, Henry, & Son, New York.
Laclede-Christy Clay Products Co., St. Louis.
Paxson, J. W. Co., Philadelphia.
Wm. Penn., Silica Works, Wm. Penn, P. O., Philadelphia.

Fire Sand:
Carborundum Co., Niagara Falls, N. Y.

Flasks:
Adams Co., Dubuque, Ia.
Barnett, Oscar, Fdy. Co., Newark.
Brass Founders' Supply Co., Newark.
Killing Molding Machine Co., Davenport, Ia.
McPhail Flask & Mch. Co., Chicago, Ill.

Flasks (Snap):
Adams Co., Dubuque, Ia.
Brass Founders Supply Co., Newark, N. J.
Diamond Clamp & Flask Co., Richmond, Ind.
Killing Molding Machine Co., Davenport, Ia.
McPhail Flask & Mch. Co., Chicago, Ill.
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Paxson, J. W. Co., Philadelphia
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Milwaukee Corres. School of Fdy., Milwaukee, Wis.

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Etting, Edward J., Philadelphia.
New England Eng. & Equip. Co., Boston, Mass.
Northern Engrng. Works, Detroit.
Obermayer, S. Co., Cincinnati.
Pangborn Company, Thomas W. New York.
Sly, W. W. Mfg. Co., Cleveland.
Standard Sand & Machine Co., Cleveland.
Stevens, F. B., Detroit.
Taylor, Robert J., Inc., Philadelphia.

Foundry Supplies:
Central Foundry Supply, Columbus, O.
Cleveland Tumbling Barrel & Mfg. Co., Cleveland, O.
Combined Foundry Supply Co., Buffalo, N. Y.
Crivel & Co., Geo. F., Buffalo.
Detroit Foundry Supply Co., Detroit.
Hill & Griffith Co., Cincinnati.
McCormick, J. S. Co., Pittsburg.
Obermayer, S. Co., Cincinnati.
Osborn Mfg. Co., Cleveland.
Pangborn Company, Thomas W. New York.
Paxson, J. W. Co., Philadelphia.
Smith, J. D., Foundry Supply Co., Cleveland.
Stevens, F. B., Detroit.
Taylor, A. L., San Francisco.
Taylor, Robert J., Inc., Philadelphia.
Whitehead Bros. Co., New York, Providence, Buffalo.

Furnaces (Melting):
Barnett, Oscar, Foundry Co., Newark, N. J.
Brass Founders Supply Co., Newark, N. J.
Fisher, Alfred, Chicago, Ill.
Hawley Down Draft Furnace Co., Chicago and New York.
Monarch Engineering & Mfg. Co., Baltimore.
Northern Eng. Wrks., Detroit, Mich.
Paxson, J. W. Co., Philadelphia.
Rockwell Engineering Co., New York.

Gates (Skim):
Harrison, Joseph, Milwaukee, Wis.

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Dixon Crucible Co., Jos., Jersey City

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Grinding Machinery:
Adams Co., Dubuque, Ia.

Heating & Ventilating Apparatus:
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Sturtevant, B. F., Co., HydePark, Mas

Hoists:
Box & Co., Alfred, Philadelphia, Pa.
General Pneumatic Tool Co., Montour Falls, N. Y.
Northern Eng. Wks., Detroit, Mich.
Pawling & Harnischfeger, Milwaukee.
Sellers, William, & Co., Inc., Philadelphia.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Whiting Fdy. Equipment Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York.

Hoists (Chain).
Chisholm & Moore Mfg. Co., Cleveland, O.

Hoists (Electric):
Quincy, Manchester, Sargent Co., Plainfield, N. J.
Northern Engrng. Works, Detroit.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Yale & Towne Mfg. Co., New York.

Hoists (Hand):
Chisholm & Moore Mfg. Co., Cleveland, O.
Northern Engrng. Works, Detroit.

Hoists (Pneumatic):
Curtis & Co. Mfg. Co., St. Louis.
Northern Eng. Wks., Detroit, Mich.
Ridgway, Craig, & Son, Coatesville, Pa.

Industrial Ry. Equipment.
Atlas Car & Mfg. Co., Cleveland
Northern Eng. Wks., Detroit, Mich.

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Hauck Mfg. Co., Brooklyn, N. Y.

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Molding Machines:
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Berkshire Mfg. Co., Cleveland.
Herman Pneumatic Machine Co., Zelienople, Pa.
Killing Molding Machine Co., Davenport, Ia.
Manning, Maxwell & Moore, New York.
Mitchell-Parks Mfg. Co., St. Louis.
Mumford, E. H. Co., Philadelphia.
Paxson, J. W. Co., Philadelphia.
Pridmore, Henry E., Chicago.
Rathbone, John A., Detroit.
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"Cyclone" High Speed Chain Hoist

WITH SELF-LUBRICATING BEARINGS

ALL CUT GEARS

1½ Tons to 16 Tons Made as Above—½ Ton and 1 Ton are Made With Single Load Chain.

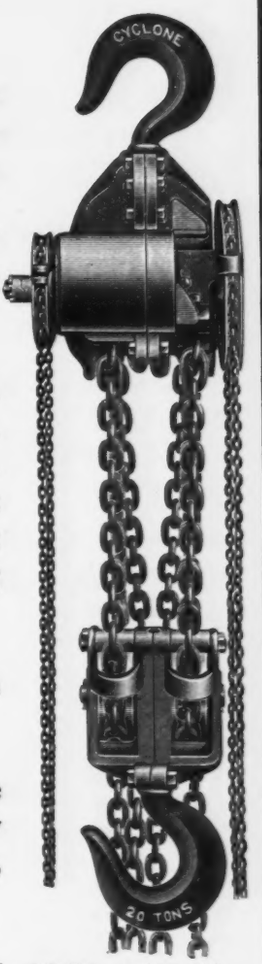
The Bearings of the Hoist have GRAPHITE BRONZE BUSHINGS. They are self-lubricating, they require no oil, and will run indefinitely without cutting.

These hoists will raise a load of two tons to a height of one foot with a pull of 125 pounds while overhauling only 39½ feet of hand chain.

As you would have to overhaul at least 90 feet of hand chain to do the same work on the best Screw Hoists, it is plain that the CYCLONE is more than twice as fast. It can be geared to a higher speed than any other hoist with no greater hand wheel pull. **There is the least possible friction loss, the efficiency averaging nearly 80 per cent.**

When there is no load the hand wheel may be spun in either direction.

When the hand chain is released the **Automatic Brake** immediately locks the block so that the load is safely held at any point. It may be readily lowered, however, by a reverse pull on the hand chain.



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Co., Philadelphia.

Sand Mixing Machinery:
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Mumford, E. H., Philadelphia.
Pangborn Company, Thomas W.
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Sellers, William & Co., Inc.,
Philadelphia.
Standard Sand & Machine Co.,
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Stockham Mfg. Co., Piqua, O.

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Shuster, F. B., Co., New Haven.
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Ross-Tacony Crucible Co.,
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Goldschmidt Thermit Co., New York.

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Paxson, J. W. Co., Philadelphia.
Peninsular Tool & Specialty Co.,
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Philadelphia Tramrail Co.,
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Northern Eng. Wks., Detroit, Mich.
Pawling & Harnischfeger, Milwaukee.

Trucks.
Northern Eng. Wks., Detroit, Mich.

Trucks (Barrel).
Cleveland Wire Spring Co., Cleveland.

Tumbling Mills:
Adams Co., Dubuque, Ia.
Cleveland Tumbling Barrel & Mfg. Co.,
Cleveland, O.
Falls Rivet & Mch. Co.,
Cuyahoga Falls, O.
Northern Eng. Wks., Detroit, Mich.
Sly, W. W., Mfg. Co., Cleveland.

Turbines:
Kerr Turbine Co., Wellsville, N. Y.

Turntables.
Northern Eng. Wks., Detroit, Mich.

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Field, Alfred & Co., New York City.

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Blake, Geo. F., Mfg. Co.,
New York City.
Shuster, F. B. Co., New Haven.

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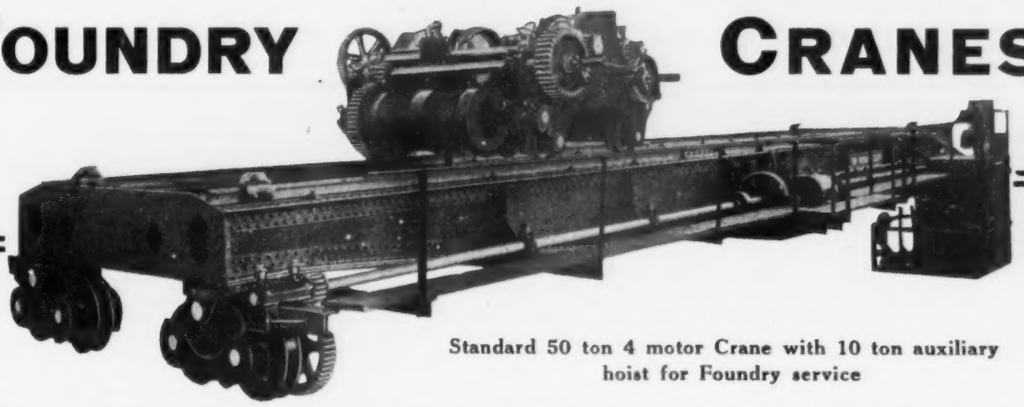
FOUNDRY CRANES



3000 Cranes in use

Capacity 3 tons and up

Standard 50 ton 4 motor Crane with 10 ton auxiliary hoist for Foundry service

Largest Manufacturers of Electric Traveling Cranes in the World. Also manufacturers of Largest Cranes in the World. Capped Bearings throughout. All Shafts removable with gears in place. All gears made of Steel. Special attention given to lubrication and interchangeable parts.

THE MORGAN ENGINEERING COMPANY

Alliance, Ohio

ESTABLISHED 1868

Builders of Hammers, Shears and all kinds of heavy special machinery.
Pioneer Crane Builders. 3000 Cranes in successful operation.

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SUPERINTENDENT WANTED FOR ORnamental and architectural iron business by established foundry. One capable of handling the entire work. Party must be able to become financially interested and willing to get in and dig. Address Box 789, THE FOUNDRY, Cleveland, O.

SUPERINTENDENT WANTED. MAN thoroughly experienced in automobile cylinder work. State experience and give references, latter of which must be A-1. Address Box 802, THE FOUNDRY, Cleveland, Ohio.

FOUNDRY FOREMAN WANTED

FOREMAN WANTED IN THE FOUNDRY manufacturing farm implements. Must be well versed in cupola practice, also the use of molding machines, mixing and melting brass for pattern work. Must be temperate in habits, of good character, progressive, and above all a good executive. None but up-to-date men need apply. Give references. All communications treated confidentially. State age, years of experience and where at present employed. Address Mechanic, care THE FOUNDRY, Cleveland, O.

FOUNDRY FOREMAN WANTED; CAPAble of instructing in light return casting. Familiar with bench and floor work, molding machines both hand and power; about 40 molders. Address Jefferson, care THE FOUNDRY, Cleveland, O.

FOREMAN WANTED FOR SMALL JOBbing foundry, well established business. Must be able to become financially interested if ability is proven. Excellent opportunity for the right man. Address Box 794, THE FOUNDRY, Cleveland, Ohio.

DO YOU WANT TO COME WEST? Foundry Foreman wanted for gray iron foundry. Good opportunity for the right man; open shop. For particulars, write to the Trinidad Foundry & Machine Company, Trinidad, Colo.

WORKING FOREMAN WANTED FOR small machine jobbing foundry. Must understand cupola and mixing. Reply wages and reference. Address Box 810, THE FOUNDRY, Cleveland, O.

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MASTER MOLDER WANTED AT $6.00 per diem. An examination will be held at the Navy Yard, Norfolk, Va., June 17, 1908, to fill the above position. For application and further information address "Commandant," Navy Yard, Norfolk, Va.

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FOREMAN WANTED FOR EACH ONE of the departments of a malleable, gray iron and steel foundry, pattern shop, core room, annealing room, etc. Also draftsman, chemist, stock-keeper, melters, etc. Only high grade men with best of references need apply. Address Federal Casting Co., 317 Traction Terminal Bldg., Indianapolis, Ind.

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POSITION WANTED ON ARCHITECtural and ornamental iron work. Superintendent seeks a change. Experienced in all departments. Expert patternmaker, modern foundry practice, molding machines, cupola and mixture of metals, brass and bronze. Up-to-date on finishing shop methods. Can handle work from start to finish. Will furnish first-class references. Address Box 772, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS SUPERINTENDent or foreman by a practical foundryman on heavy and light gray iron castings. Well experienced on cupola and molding machines. Will furnish A-1 references. Address Box 740, THE FOUNDRY, Cleveland, O.

BRASS AND ALUMINUM FOREMAN and superintendent desires position. Experienced on heavy and light bench and floor work and well up on modern foundry practice. Best of references furnished. Address Box 809, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS SUPERINtendent in large brass foundry; valves specialty. 16 years' experience. Up-to-date on molding machines and modern melting, also chemist. Western states preferred. Address Box 804, THE FOUNDRY, Cleveland, Ohio.

POSITION WANTED AS SUPERINTENDent by man thoroughly capable of taking entire charge of gray iron foundry. Up-to-date on light and medium castings and have good executive ability. Address Box 803, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOUNDRY SUperintendent or foreman; 20 years' experience on pumps and valves; 10 years' as foreman. Will furnish A-1 references. Thoroughly understand cupola practice, also molding machines. Address Box 795, THE FOUNDRY, Cleveland, O.

FOREMANSHIP WANTED

SITUATION WANTED BY AN A-1 foundry foreman. Capable of handling men. Practical molder and core maker. Up-to-date on molding machines and cupola work. Best of references furnished. Am open for engagement. Address Box 788, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY EXPERIENCED foundryman, 30 years old. Have been on loam, dry sand and green sand, and held the position as foreman for two large foundries for the past 20 years. Will invest some money if necessary. Experienced in cupola work. Address Box 791, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY UP-TO-DATE foundry foreman well up in molding machine practice. Can handle men to advantage on any class of foundry work. Strictly temperate. Address Box 805, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY A1 FOUNDRYman who will be at liberty shortly. Well versed in modern foundry practice and gray iron jobbing. Boiler and radiator work preferred. Correspondence solicited. Address Box 759, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOREMAN OR assistant foundry foreman; 32 years old, 16 years in general jobbing foundry, four years of this foreman. Can furnish good references on light and heavy work, green or dry sand. Address Box 780, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOUNDRY foreman. Am 41 years of age and have had 19 years' experience as molder; over 10 years as foreman. Understand molding machines and can mix iron for light and heavy work. Can handle men at minimum cost. Address Box 793, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY FOUNDRY foreman, sober and reliable. Can give best of reference. Understands machines and cupolas. Open shop preferred. Address Box 807, THE FOUNDRY, Cleveland, O.

POSITION WANTED AS FOUNDRY foreman; 15 years' malleable foundry practice. Practical molder, floor, bench, and machine. Good handler of men. Address Box 801, THE FOUNDRY, Cleveland, O.

BRASS FOUNDRY FOREMAN DESIRES position as foreman. Am up-to-date in all branches of the trade. Used to light, medium and heavy work. Can furnish A-1 references. Address P. F. Q., General Delivery, Lockport, Ill.

FOUNDRY FOREMAN OR ASSISTANT, at present employed as such, wishes to make a change. Age 41, thoroughly experienced on both heavy and light work. Correspondence solicited. Address Box 797, THE FOUNDRY, Cleveland, O.

POSITIONS WANTED, MISCELLANEOUS

POSITION WANTED BY EXPERIENCED molder in good shop, or would take charge of small foundry. Country preferred. I. C. S. student. Address Box 796, THE FOUNDRY, Cleveland, O.

POSITION WANTED BY EXPERT MALleable iron annealer. Address Box 790, THE FOUNDRY, Cleveland, Ohio.

POSITION WANTED AS BOOKKEEPER or auditor. Married man, 29 years old; at present employed by large firm of accountants. Several years' practical experience in sundry office duties, with Foundry, Radiator and Iron and Steel Industries. Satisfactory references. Address "Bookkeeper," THE FOUNDRY, 1328 Monadnock Bldg., Chicago, Ill.

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WANTED TO INVEST $1,000.00 with services as foreman or working foreman in medium-sized foundry in the west or southwestern country. 20 years' experience as machinery molder and foreman. Address Box 799, THE FOUNDRY, Cleveland, O.

PARTNER WANTED IN GRAY IRON foundry with machine shop in connection. $5,000.00 will secure half interest in an established and paying foundry business in Jersey, 15 miles from New York City. Need more capital to purchase additional equipment. Practical man preferred to act as superintendent. Address Box 808, THE FOUNDRY, Cleveland, O.

PROPERTY FOR SALE

STOVE PLANT FOR SALE. THE UNdersigned will offer For Sale at public auction the land, buildings, equipment, material and stock belonging to the Leonard Stove & Range Company, located at Bowling Green, Ohio, at the office of the said company on Tuesday, June 30, at 10 A. M. Certified check of $500 will be required from all bidders. This plant is brand new and is in first class shape for immediate operation. The buildings composing the plant are of brick construction and are as follows:

One molding room 54 ft. x 126.
One cupola room 20 x 21.
One rattling room 24 x 126.
One mounting and nickeling room 56 x 120.
One engine room 25 x 44.
One warehouse 72 x 145.
One pattern storage vault 24 x 30.
One carpenter shop 26 x 35.
One office building 25 x 31.

Buildings are planned and arranged for the rapid and economical handling of material in process of manufacture. Equipment for the plant consists of, one No. 4 direct connected Piqua Blower, one Newton Cupola 54 in. shell, four Rattlers, one Russell Automatic steam engine 60 H. P., one steam boiler, also punch presses, drill presses, brakes and such equipment as is used in the manufacture of steel ranges and heating stoves. There is on hand approximately 150 tons of pig iron, 50 tons of sheets, also a large quantity of castings ready to mount, together with stove trimmings, rivets, stove plates, etc. A complete set of patterns gated and fallow-boarded, together with flasks for complete line of oak heating stoves, also steel and cast ranges and laundry stoves, about two carloads of finished heating stoves in warehouse. Plant is situated on main line, T. & O. C. Railway with switch running the entire length of plant. Plant appraised at $40,000. For further information write or call D. W. Pugh, Trustee in Bankruptcy, Bowling Green, Ohio.

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1 No. ½ Roots blower.
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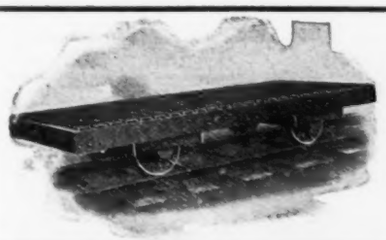

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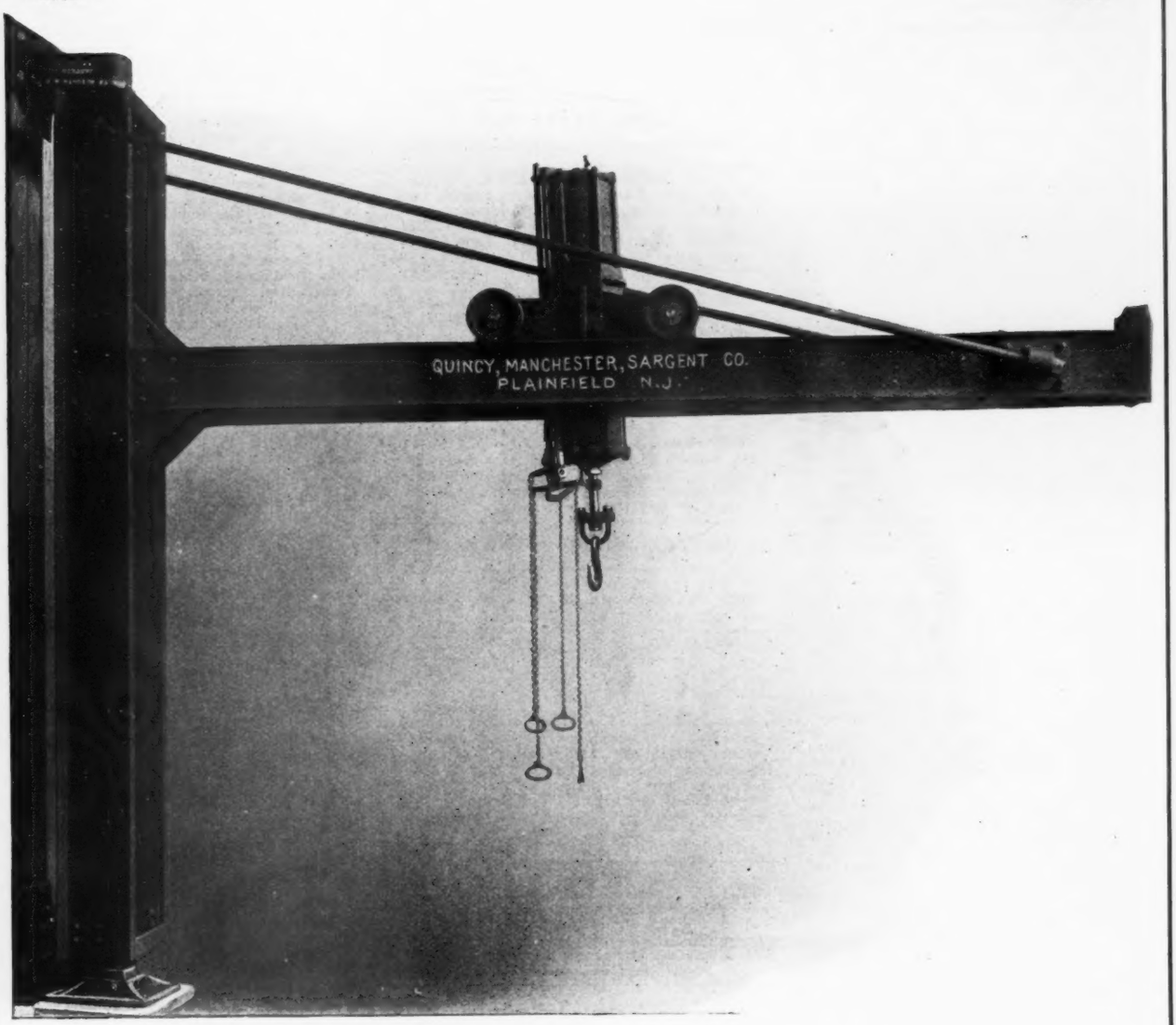

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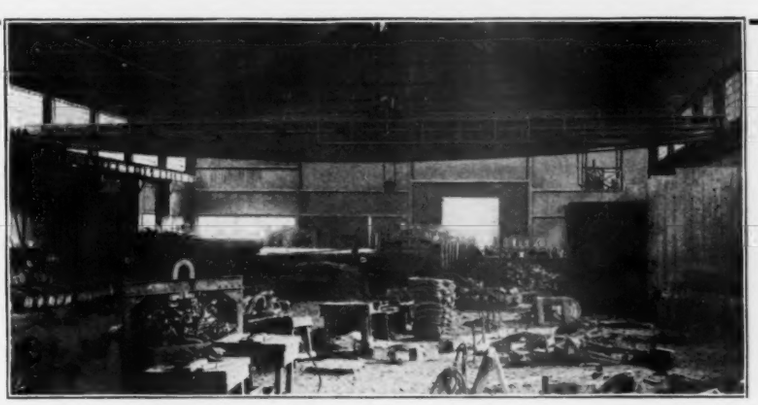

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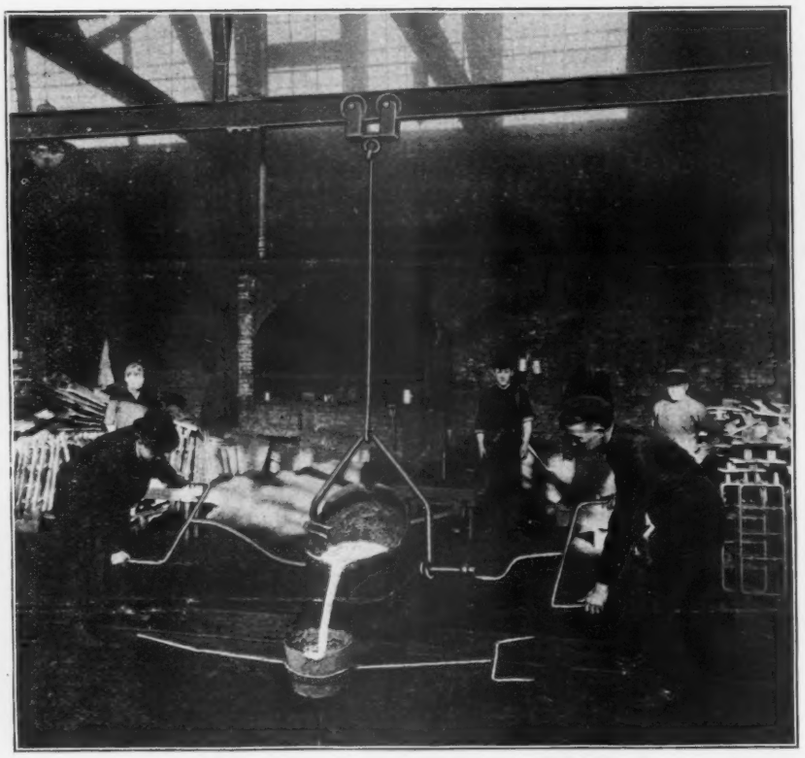

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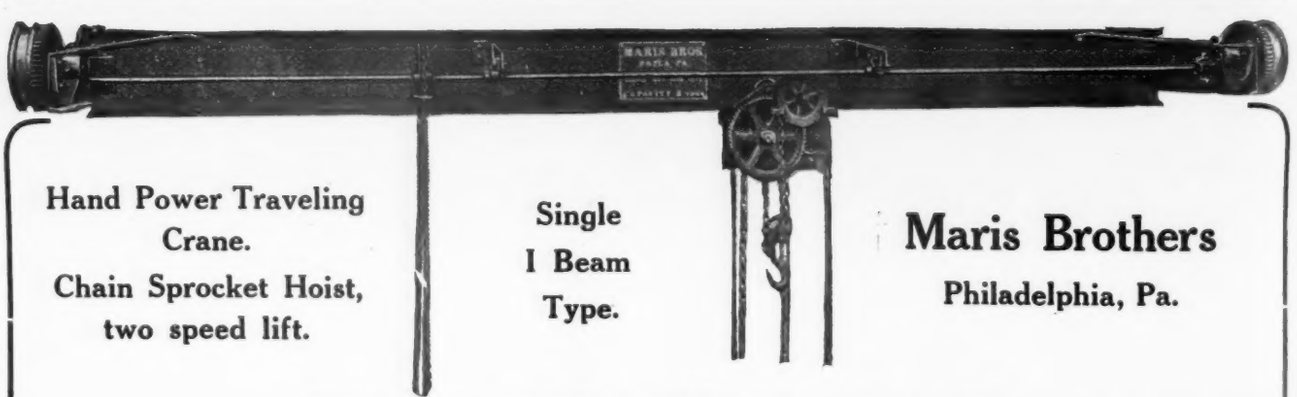

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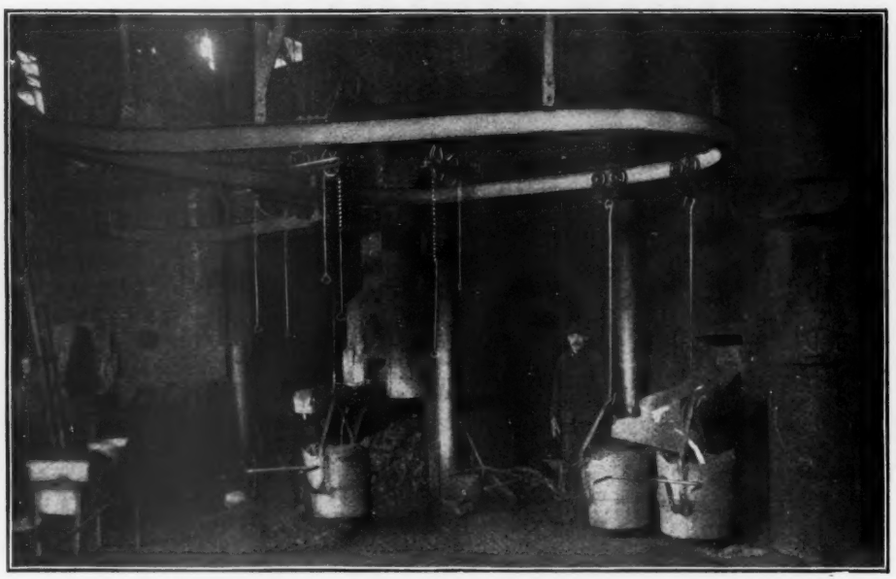

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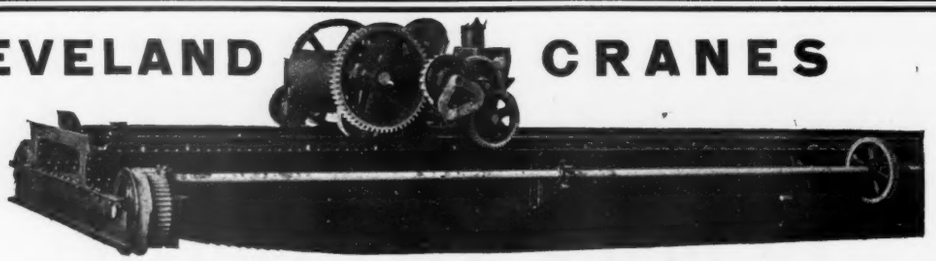

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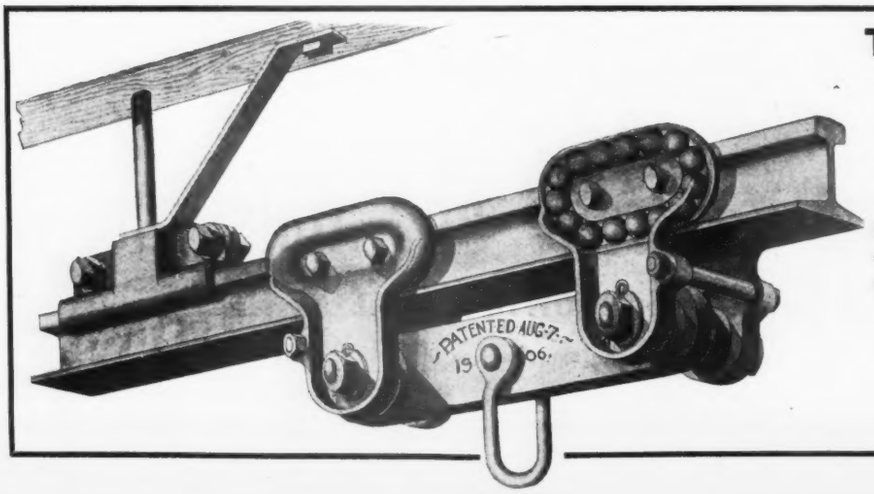

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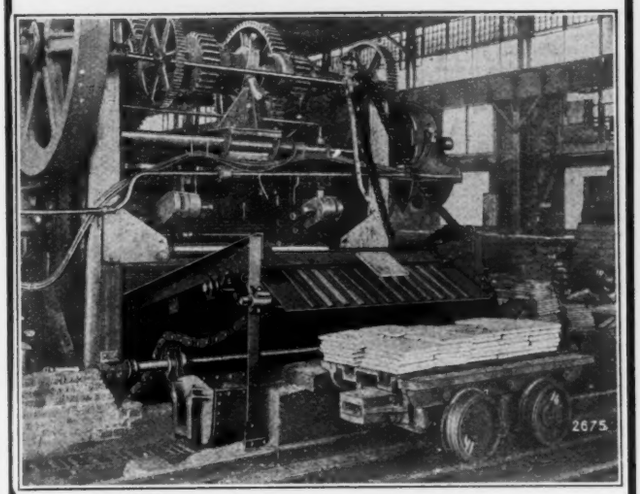

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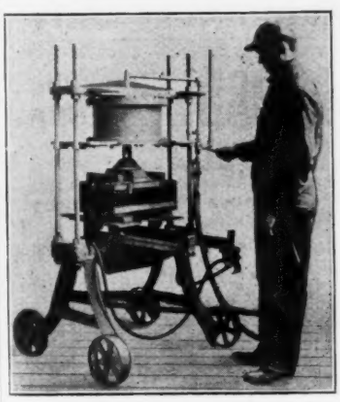

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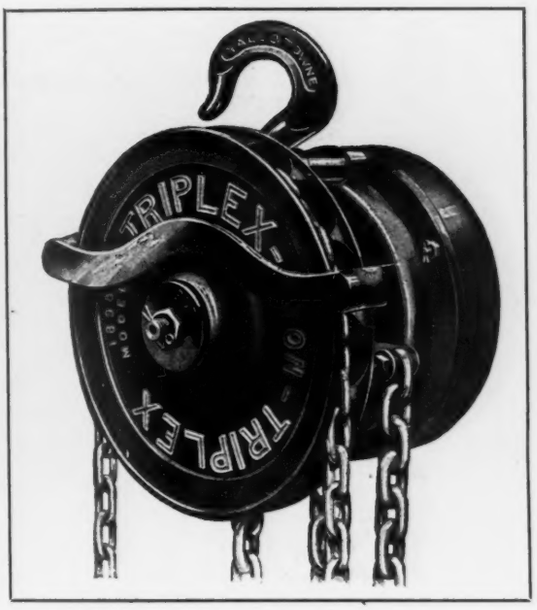

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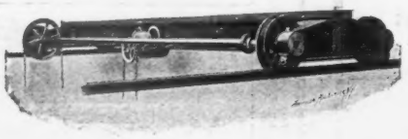

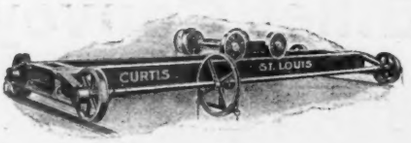

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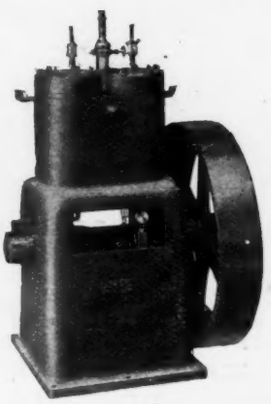

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